BRITISH COLUMBIA

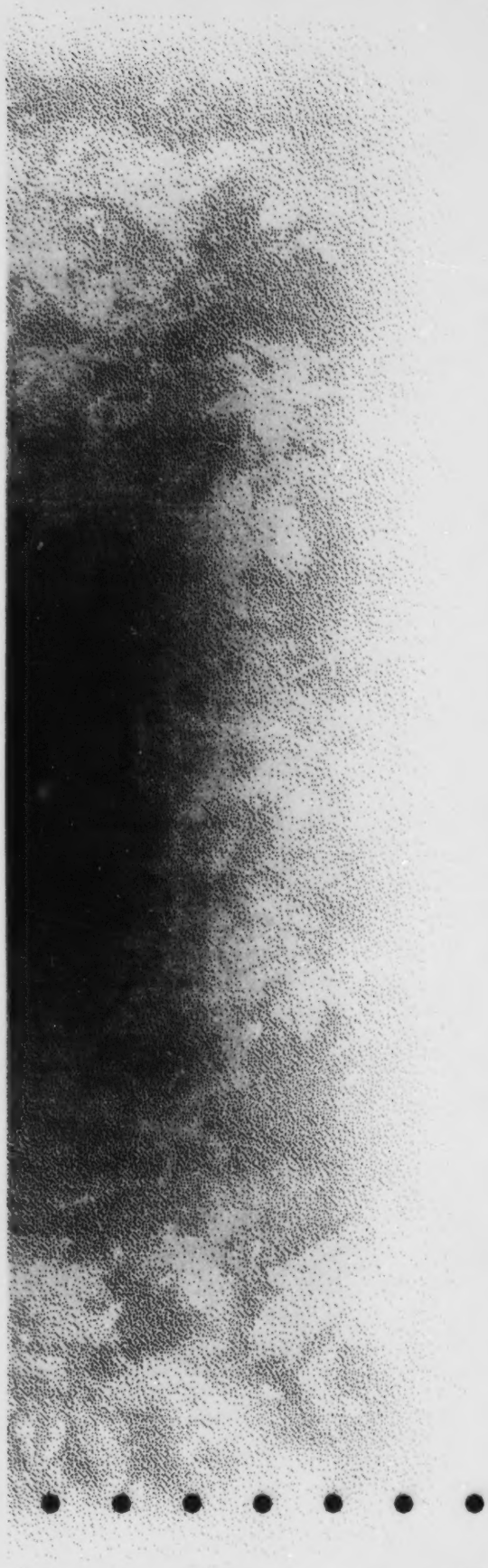
Ministry of Transportation and Highways

WARS 1999

Wildlife Accident Reporting System

1999 Annual Report

(1995 to 1999 Synopsis)



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WARS Wildlife Accident Reporting System
1999 Annual Report (1995 — 1999 Synopsis)

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Abstract: The Wildlife Accident Reporting System (WARS) is designed to collect and store information on wildlife killed on highways in British Columbia. Wildlife accident information is used by the Ministry to detect accident trends. The data is used for identifying highway locations that require wildlife mitigation and in establishing policies and strategies for the entire province.

Comments: In 1999, Ministry Maintenance Contractors reported finding 4888 dead wild animals on British Columbia highways. Approximately 80% of the animals reported killed were deer. The number of wildlife accidents reported to the Ministry increased 6% since 1998.

Keywords: WARS, Wildlife Accident Reporting System, wildlife, wildlife kills, wildlife accidents, accident statistics, wildlife reflectors, wildlife fencing, British Columbia, cost

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WARS Wildlife Accident Reporting System

1999 Annual Report

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Map 4. Maintenance Contract Areas

APPENDIX A

Ministry Maintenance Contract Areas

APPENDIX B

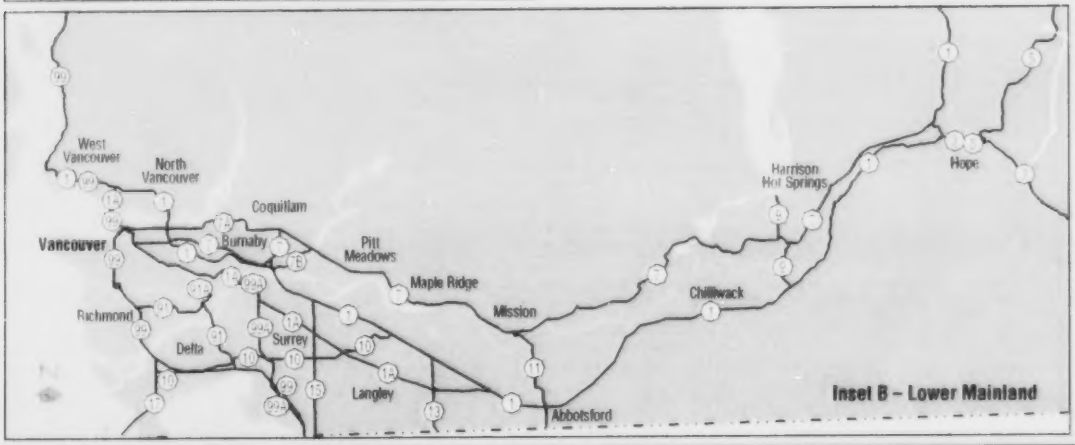
Wildlife Accident Reporting System (WARS) form H-107 (1999/01)

100-07583/

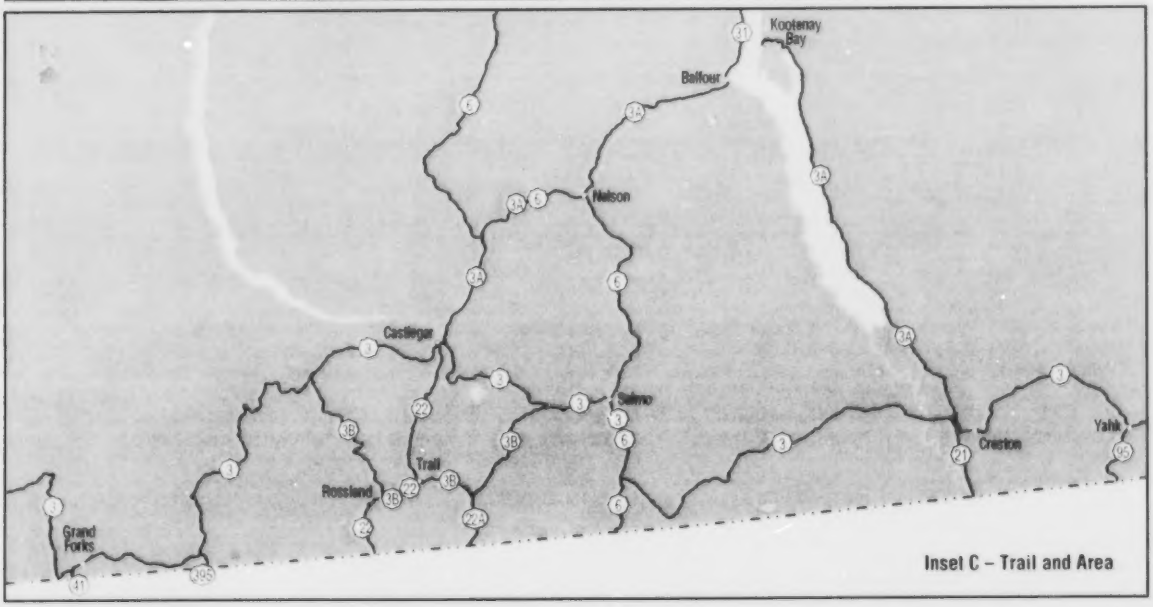
MAPS

Map 1. Numbered Highways in British Columbia
Map 2. Transportation Regions and Major Highways of British Columbia
Map 3. Regions and Districts
Map 4. Maintenance Contract Areas

Inset A – South Eastern Vancouver Island



Inset B – Lower Mainland

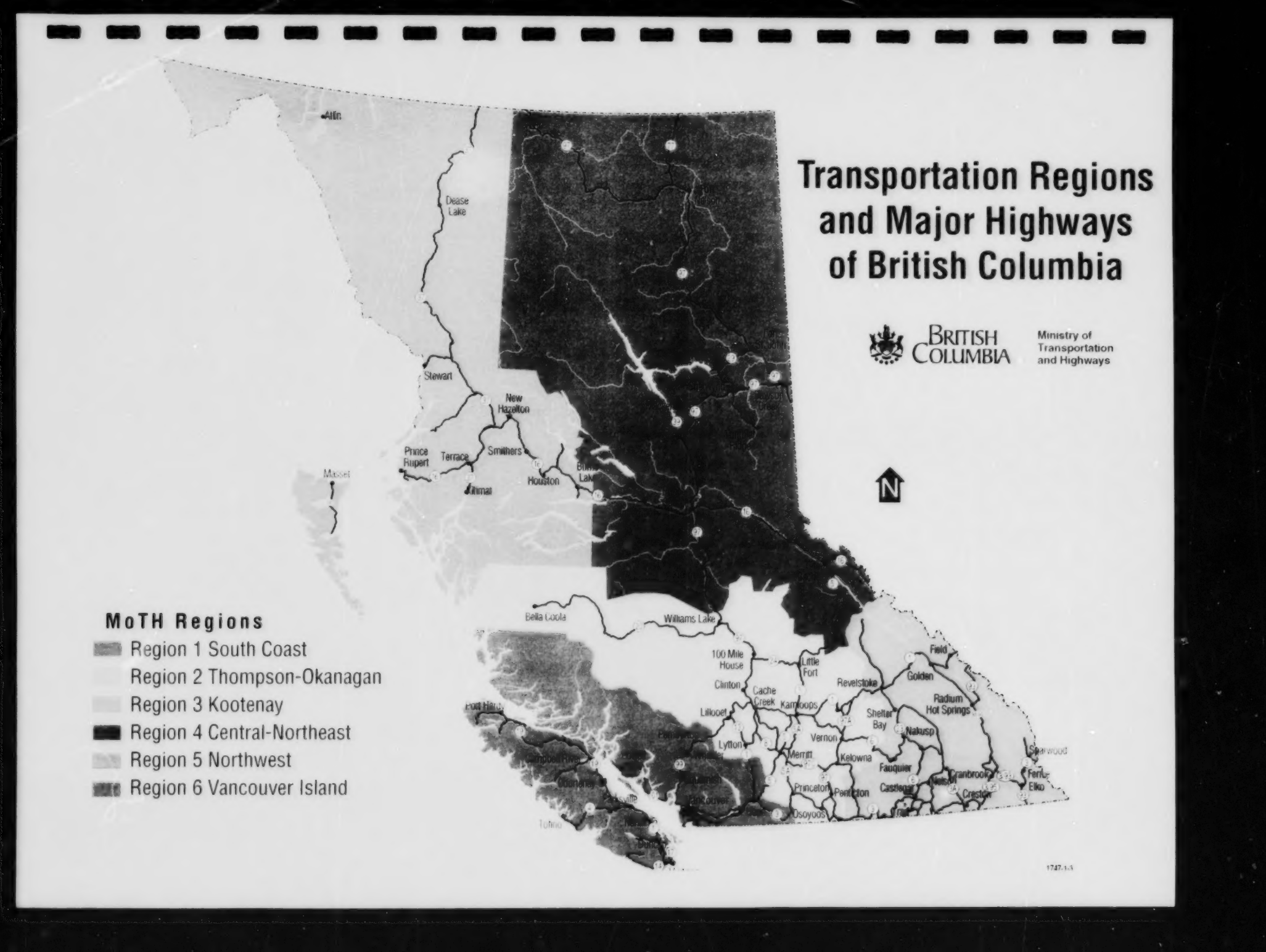


Inset C – Trail and Area

Numbered Highways in British Columbia

BRITISH COLUMBIA

Ministry of Transportation and Highways


Transportation Regions and Major Highways of British Columbia
BRITISH COLUMBIA
Ministry of Transportation and Highways
MoTH Regions
Region 1 South Coast
Region 2 Thompson-Okanagan
Region 3 Kootenay
Region 4 Central-Northeast
Region 5 Northwest
Region 6 Vancouver Island
Dease Lake
Stewart
New Hazelton
Prince Rupert
Terrace
Smithers
Houston
Bella Coola
Williams Lake
100 Mile House
Clinton
Cache Creek
Kamloops
Lillooet
Lytton
Merritt
Vernon
Kelowna
Princeton
Penticton
Osoyoos
Revelstoke
Golden
Field
Radium Hot Springs
Shelter Bay
Nakusp
Fauquier
Castlegar
Cranbrook
Creston
Elko
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BRITISH COLUMBIA

Ministry of Transportation and Highways

Regions and Highways Districts 1999

Regions and Districts

Region 1 South Coast Region
- 4 - Howe Sound District
- 5 - Electrical District
- 6 - Lower Mainland District
- 7 - Fraser Valley District

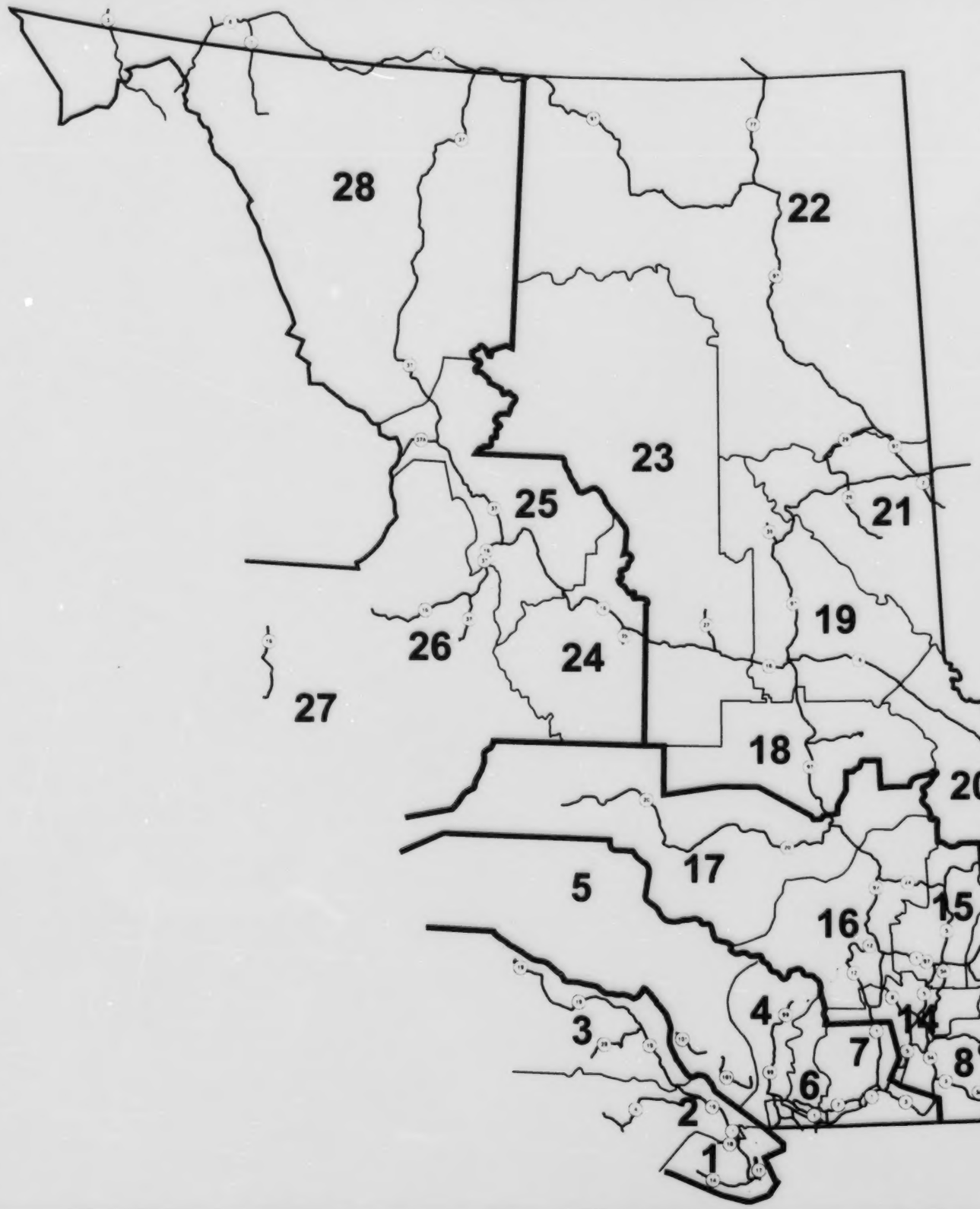
Region 2 Thompson-Okanagan Region
- 8 - South Okanagan District
- 13 - Okanagan-Shuswap District
- 14 - Nicola District
- 15 - Thompson District
- 17 - Cariboo District

Region 3 Kootenay Region
- 9 - Kootenay Boundary District
- 10 - Central Kootenay District
- 11 - East Kootenay District
- 12 - Selkirk District

Region 4 Central-Northeast
- 18 - North Cariboo District
- 19 - Fort George District
- 20 - Robson District
- 21 - South Peace District
- 22 - North Peace District

Region 5 Northwest Region
- 25 - Bulkley-Lakes District
- 26 - Skeena District
- 28 - Stikine District

Region 6 Vancouver Island
- 1 - South Island
- 2 - Central Island
- 3 - North Island



BRITISH COLUMBIA

Ministry of Transportation and Highways

Maintenance Contract Areas

1 South Island	15 Thompson
2 Central Island	16 South Cariboo
3 North Island	17 Central Cariboo
4 Howe Sound	18 North Cariboo
5 Sunshine Coast	19 Fort George
6 Lower Mainland	20 Robson
7 Fraser Valley	21 South Peace
8 South Okanagan	22 North Peace
9 Kootenay Boundary	23 Nechako
10 Central Kootenay	24 Lakes
11 East Kootenay	25 Bulkley Nass
12 Selkirk	26 Skeena
13 Okanagan - Shushwap	27 North Coast
14 Nicola	28 Stikine

Legend

- Regional Boundary
- District Boundary
- Highway

INTRODUCTION

Overview

The Environmental Management Section, Engineering Branch, British Columbia Ministry of Transportation and Highways (MoTH), administers and maintains the Wildlife Accident Reporting System (WARS), a system designed to collect and store information on wildlife killed and retrieved on numbered highways in British Columbia.

Wildlife accident information is used by the Ministry to compile statistics for detecting and evaluating accident trends. This data is particularly valuable for identifying highway sections that require wildlife mitigation and in establishing practical policies and strategies for the entire province. WARS is also used as an evaluation tool for the effectiveness of various mitigation methods by comparing the number of accidents before and after mitigation techniques are employed. The Ministry's Regional Environmental Coordinators have direct access to the WARS system and provide wildlife-related motor vehicle accident information to Ministry Regional and District offices.

The Ministry of Environment, Lands and Parks (MELP) also uses the data to assess wildlife population trends in its management units. Data from the WARS system is used by the Insurance Corporation of British Columbia (ICBC) for identifying roads where mitigation measures can be targeted in joint Ministry/ICBC initiatives to reduce wildlife-related motor vehicle accidents.

Methodology

Wildlife accidents are recorded by the Ministry's Road and Bridge Maintenance Contractors located in the Ministry Contract Areas (Appendix A). Data regarding wildlife-vehicle accidents, such as location and species, are recorded on WARS forms H-107 (1999/01) (Appendix B). These forms are compiled by each Highway District office and then sent on a monthly basis to the Engineering Branch. The forms are screened, coded and then entered into the electronic database.

Reporting

The accident data are used to produce a variety of reports including Annual Reports for each calendar year and a wide range of adhoc reports. Annual Reports provide detailed information and analyses of wildlife-vehicle accidents for a given year. Five-year reports provide considerable information of wildlife-vehicle accidents over half a decade and examine trends such as frequency, location and severity of these accidents. Adhoc reports are created for people in need of specific information, such as how many deer have died along a particular highway segment over the past ten years. Approximately a third of these inquiries were from Ministry of Transportation and Highways personnel. The remaining inquiries were from other government agencies, consultants, researchers,

news media, various wildlife associations, interest groups and members of the general public.

Assumptions and Constraints

The Ministry estimates that the number of wild animals recorded by the WARS system represents only about 20% to 30% of the actual number of wild animals killed. The low number of reports can be attributed to a number of factors. In high traffic areas, the remains of small species of wildlife, like foxes and racoons, often become unrecognizable after being run over by a number of vehicles. Some animals, primarily deer, are removed from the roadside by passing motorists before they are recorded by Ministry Maintenance Contractors.

Data is also lost due to the following:

- animals die outside the highway right-of-way,
- animal remains are removed by natural predators or scavengers,
- animal remains are obscured by snow, ice, vegetation, or roadside debris, and
- errors and omissions in reporting and data processing.

WARS contains data on wildlife-vehicle accidents dating back to 1978. The data used in this report represents all the data for the 1999 reporting year received from District offices and Maintenance Contractors up until March 8, 2000.

Although WARS data prior to the mid-eighties are not as complete or detailed as more recent data, it facilitates the analysis of long term trends in the number of animals struck, and the consistency of the location sites. WARS is a flexible system which attempts to meet a broad range of requirements, from producing site specific reports over a few kilometres to creating detailed reports of various aspects of wildlife-vehicle accidents for the entire province.

Data Quality

WARS reports, based on Provincial, Regional and District level data, are an excellent means of gaining a detailed understanding of the wildlife-vehicle accident patterns for the Province.

In 1999, of the 4886 reports received, 20% lacked valid segment numbers, and 37% lacked valid kilometre references. These reports did not contain enough information for Environmental Management Section staff to determine the valid segment numbers and km references. This was a significant improvement over 1995, when 28% lacked valid segment numbers and 44% lacked valid km references. The quality of reporting continues to improve. When Wildlife Accident Report Forms are filled out correctly and

consistently with the necessary LKI and km information, the value of the WARS data to the Ministry, Maintenance Contractors, and others increases.

The Maintenance Contractors' positive response to the new WARS forms H-107 (1999/01) appears to be addressing the issue of data completeness and accuracy. To date, the data provided on the new H-107 forms for 1999 is more complete and accurate, and thus more valuable for analysis and outcomes.

WARS data helps the Ministry direct its limited financial resources for wildlife accident mitigation to locations where it is most needed. The Insurance Corporation of British Columbia (ICBC) also uses WARS data to evaluate Ministry cost-sharing proposals for highway safety projects. Since each wildlife-related accident clean-up can cost hundreds of dollars in Maintenance Contractor staff and equipment time, the WARS system can direct Ministry attention to high wildlife accident locations to reduce the operating costs for Maintenance Contractors

WARS Enhancements

In 1994, two notable enhancements were made to the system. The first of these was expanding on the Potential Hazard reporting function of the system. In addition to Potential Hazard Reports for specified highways, the system can now also produce Potential Hazard Reports by Province, Region and District. This function can identify where accidents are most likely to occur within the area of concern whether it is a particular highway or Region. The second enhancement involved the capability of the system to report on the location of wildlife mitigation measures throughout B.C. WARS now contains up-to-date information on the location of wildlife fencing, reflectors and wildlife warning signs throughout the Province.

Region and District Boundary Changes

Changes in the Region and District boundaries, which occurred between 1997 and 1999, are reflected in the information presented in this report.

- District 16 of Region 2 was amalgamated with District 17 of Region 4 to form District 17 in Region 2,
- In Region 4, District 19 was amalgamated with District 23 to form District 19, and
- In Region 5, District 24 was amalgamated with District 25 to form District 25.

In each amalgamated district, the Ministry Maintenance Contractors continue to collect WARS data separately for the Maintenance Contract Service Areas that remain in the former districts (Appendix B). The data is merged at Ministry Headquarters for reporting purposes.

REGIONAL AND DISTRICT ACCIDENT STATISTICS

Overview

In 1999, MoTH Maintenance Contractors reported 4888 wildlife-vehicle accidents. This is an increase of 6% from 1998 (Table 1). The increase can be contributed to a variety of factors including seasonal climatic variations, increasing animal populations, and changes in migratory patterns.

Table 1. Wildlife Accidents in B.C. (1990 to 1999)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Accidents	3661	3306	3176	4680	5262	4764	3853	3661	4576	4888

Figure 1 illustrates the ten year trend for reported wildlife-vehicle accidents. It appears the accident rate has increased after a three year decline from the peak in 1994. The 1994 peak may be attributed to correlated longer term climatic patterns, seasonal animal behavior, fluctuating traffic volumes, or greater diligence by Ministry Maintenance Contractors.

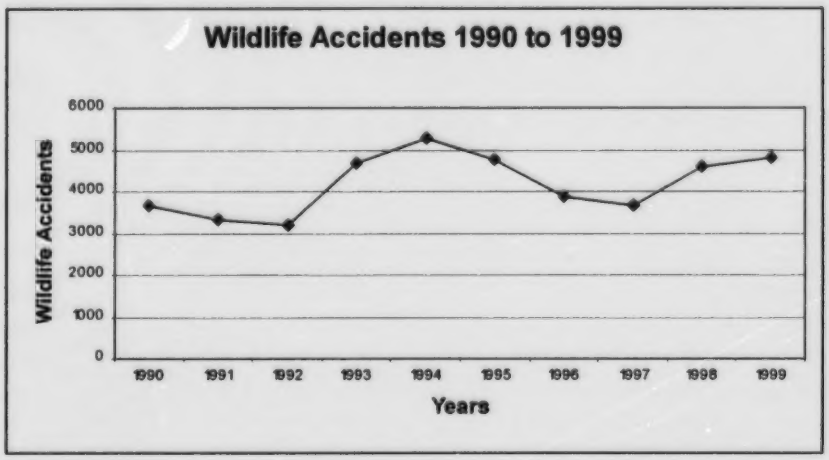


Figure 1. Wildlife Accidents (1990 to 1999)

Regional Comparisons

Table 2 provides a breakdown of wildlife accidents by Regions from 1995 to 1999. Given the size of the province and the dramatically different climatic and geographical regimes within each region, variations between regions may vary significantly. For example, depending on weather patterns, Region 6 can experience a very wet winter but exhibit fewer wildlife accidents, while Regions 2 and 3 can experience heavy snowfalls with higher wildlife accidents as animals migrate from higher elevations to valleys where highways are located.

Table 2. Wildlife Accidents by Region (1995 to 1999)

Region	1995	1996	1997	1998	1999	Totals
1	232	157	159	179	201	**928**
2	877	711	952	1,139	1,026	**4,705**
3	1,649	1,411	955	1,307	1,501	**6,823**
4	1,083	673	608	891	953	**4,208**
5	190	162	211	182	220	**965**
6	733	739	765	878	987	**4,102**
Totals	**4,764**	**3,853**	**3,650**	**4,576**	**4,888**	**21,731**

When comparing 1999 wildlife-vehicle accidents by Region to those during previous years, it is important to note that, the fluctuation between years can be considerable (Table 3).

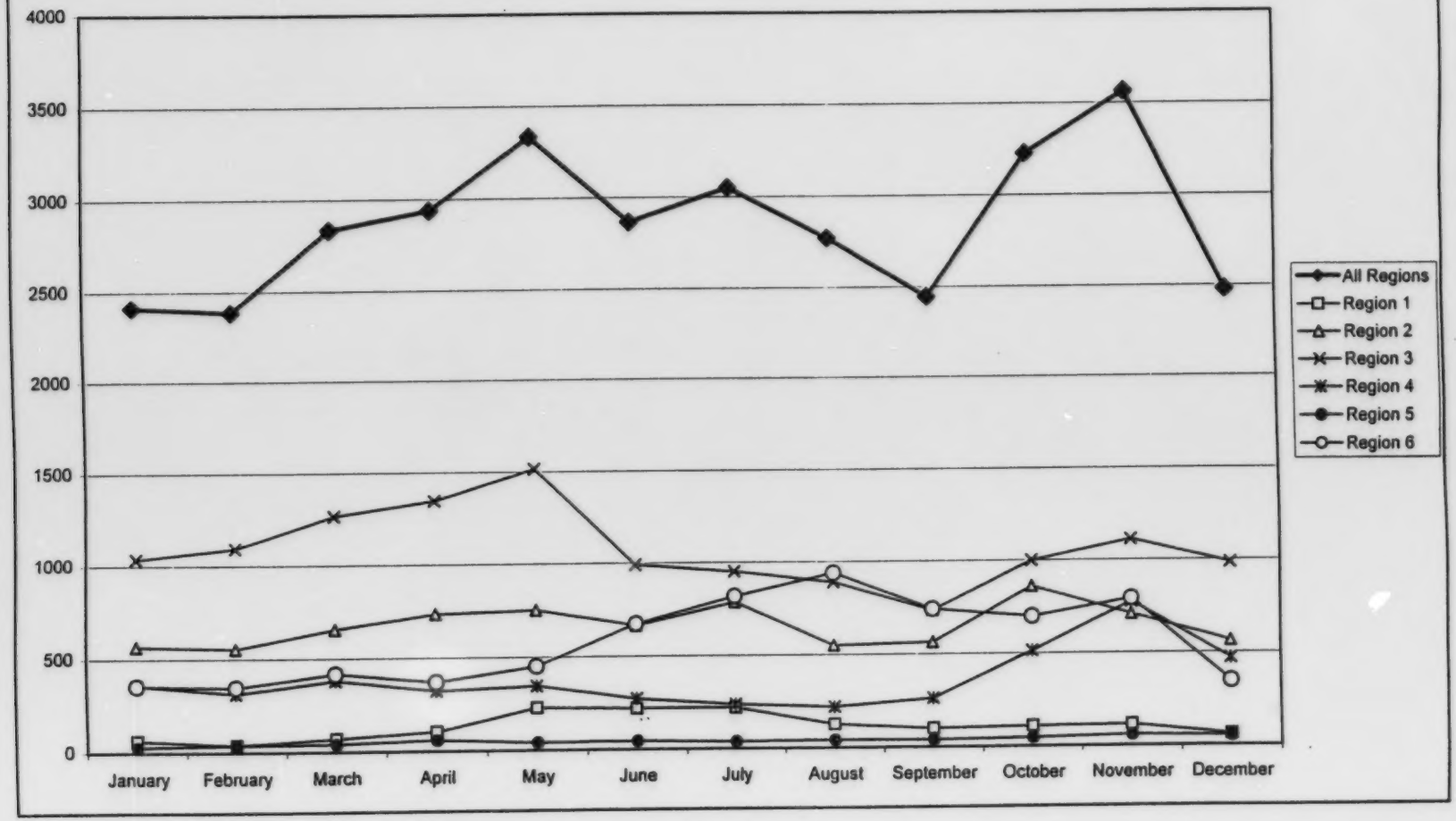
Table 3. Regional Wildlife Accidents Comparisons (1995 to 1999)

Region	1995	1996	% Change	1996	1997	% Change	1997	1998	% Change	1998	1999	% Change
1	232	157	**-32.3**	157	159	**1.3**	159	179	**12.6**	179	201	**12.3**
2	877	711	**-18.9**	711	952	**33.9**	952	1,139	**19.6**	1,139	1,026	**-9.9**
3	1,649	1,411	**-14.4**	1,411	955	**-32.3**	955	1,307	**36.9**	1,307	1,501	**14.8**
4	1,083	673	**-37.9**	673	608	**-9.7**	608	891	**46.5**	891	953	**7.0**
5	190	162	**-14.7**	162	211	**30.2**	211	182	**-13.7**	182	220	**20.9**
6	733	739	**0.8**	739	765	**3.5**	765	878	**14.8**	878	987	**12.4**
Total	4,764	3,853	**-19.1**	3,853	3,650	**-5.3**	3,650	4,576	**25.4**	4,576	4,888	**6.8**

When the monthly distribution of wildlife-vehicle accidents for all species in each Region for the period between 1990 and 1999 are compared, trends appear (Figure 2). Collectively, the accident rate for all Regions peaks in May and November. Since deer represent approximately 80% of the animals killed, the patterns of accidents for other species is overshadowed by the pattern found for deer in all Regions.

The general pattern of wildlife accidents for the entire Province is greatly influenced by the number of deer-vehicle accidents recorded in Region 3. This Region has disproportionately more accidents than any other Region. The general pattern of Region 3 is reinforced by similar patterns observed in Regions 2 and 4. Regions 2, 3 and 4 have some of the highest deer populations in the Province. These Regions have areas with steep mountainous terrain transected by Highways 1, 3, 16 and 97. The trend observed in Region 6 (Vancouver Island) differs from the other Regions with no peak in May, but a peak in August.

Figure 2. Total Monthly Deer Accidents by Region
(1990 - 1999)



District Comparisons

Table 4 provides a breakdown of wildlife-vehicle accidents as recorded by Districts. The distribution ranges from 13 wildlife-vehicle accidents recorded in District 28 to 584 recorded in District 11. Given the varying District sizes, geography, highway infrastructures, and bioclimatic regimes, great variations in wildlife accident rates occur between Districts.

Table 4. Wildlife Accidents by District

District	1997	1998	1997/1998 % Change	1998	1999	1998/1999 % Change
1	273	297	8.8	297	310	4.4
2	224	268	19.6	268	301	12.3
3	255	313	22.7	313	362	15.7
4	28	34	21.4	34	89	161.2
6	8	50	525.0	50	38	-24.0
7	81	95	17.3	95	74	-22.1
8	358	334	-6.7	334	287	-14.1
9	322	517	60.6	517	523	1.2
10	202	247	22.3	247	305	23.5
11	347	511	47.3	511	584	14.3
12	45	32	-28.9	32	75	134.4
13	98	244	149.0	244	215	-11.9
14	60	75	25.0	75	90	20.0
15	115	125	8.7	125	139	11.2
17	272	361	32.7	361	286	-20.8
18	142	145	2.1	145	167	15.2
19	53	77	45.3	77	83	7.8
20	65	146	124.6	146	222	52.1
21	290	492	69.7	492	410	-16.7
22	32	31	-3.1	31	76	145.2
25	89	89	0.0	89	128	43.8
26	104	89	-14.4	89	76	-14.6
28	1	4	300.0	4	13	225.0

Highway Comparisons within Districts

Table 5 provides a five year comparison breakdown of wildlife-vehicle accidents as recorded by Ministry Maintenance Contractors within each District. Highways 1, 3, 16 and 97 have the highest number of recorded wildlife-vehicle accidents. These highways are the longest in the province, carrying the greatest volumes of traffic, and traversing many of the major wildlife habitats.

Table 5. Wildlife Accidents by District and Highway (1995-1999)

REGION 1

District 4 – Howe Sound ([1]Service Area 4 – Howe Sound, [2]Service Area 5 – Sunshine Coast, [3]Both)						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
1[1]	2	7	0	2	2	13
99[1]	16	30	0	1	16	63
101[2]	25	18	4	13	23	83
Various[3]	30	28	24	18	48	148
Totals	73	83	28	34	89	307

District 6 – Lower Mainland						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
1	12	10	4	4	0	30
7	5	17	6	2	13	43
10	1	1	1	1	0	4
15	0	0	0	2	0	2
99	9	1	1	2	1	14
Various	53	15	3	39	24	134
Totals	80	44	15	50	38	227

District 7 – Fraser Valley						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
1	57	47	47	62	32	245
3	12	21	21	18	21	93
5	2	6	6	0	0	14
7	4	5	5	6	2	22
9	0	0	0	0	0	0
11	0	2	2	2	0	6
Various	5	17	17	7	19	65
Totals	80	98	98	95	74	445

REGION 2

District 8 – South Okanagan						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
3	92	66	52	60	87	357
3A	3	29	6	18	10	66
3B	5	3	3	3	0	14
5A	24	10	1	6	11	52
33	19	15	20	30	29	113
97	96	123	260	160	95	734
97C	3	0	0	0	0	3
Various	46	26	51	57	56	236
Totals	288	272	393	334	288	1575

District 13 – Okanagan-Shuswap						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
1	20	23	29	29	58	159
6	62	27	56	56	45	246
33	0	0	0	0	2	2
97	8	16	75	75	37	211
97A	13	26	21	21	20	101
Various	23	13	63	63	56	218
Totals	126	105	244	244	218	937

District 14 – Nicola						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
1	10	17	6	3	7	43
5	44	50	22	42	52	210
5A	8	5	7	3	1	24
8	2	3	1	5	1	12
97C	16	26	13	17	22	94
Various	10	17	34	5	10	76
Totals	90	118	83	75	93	459

District 15 – Thompson						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
1	43	34	57	56	50	240
5	62	44	67	57	75	305
24	0	0	3	4	4	11
Various	4	2	2	8	10	26
Totals	109	80	129	125	139	582

District 17 – Cariboo ([1]Service Area 16 - South Cariboo, [2]Service Area 17 – Central Cariboo, [3]Both)						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
1[1]	20	11	5	12	5	53
12[1]	3	0	0	1	0	4
20[2]	28	25	56	39	37	185
24[1]	11	19	17	28	23	98
97[3]	80	131	138	200	145	694
97C[1]	2	1	0	0	1	4
99[1]	5	0	1	1	2	9
Various[3]	66	44	69	81	75	335
Totals	215	231	286	362	288	1382

REGION 3

District 9 – Kootenay Boundary						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
3	293	304	185	318	272	1372
3A	5	5	3	1	0	14
3B	9	6	6	4	0	25
22	38	21	5	0	1	65
33	176	147	95	139	170	727
Various	75	37	31	55	84	282
Totals	596	520	325	517	527	2485

District 10 – Central Kootenay						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
3	53	57	36	68	81	295
3A	104	81	38	40	42	305
6	178	155	113	99	137	682
21	1	0	0	4	2	7
23	17	10	3	3	9	42
31	39	31	15	20	17	122
31A	9	5	1	5	4	24
Various	14	9	12	8	14	57
Totals	415	348	218	247	306	1534

District 11 – East Kootenay						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
3	254	218	131	213	197	1013
43	45	22	12	24	6	109
93	54	44	42	63	138	341
95	114	117	87	143	64	525
95A	62	43	26	30	63	224
Various	18	10	40	38	119	225
Totals	547	454	338	511	587	2437

District 12 – Selkirk						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
1	54	44	35	13	38	184
23	9	16	7	12	4	48
31	0	0	0	1	0	1
95	1	20	9	1	16	47
Various	27	9	0	5	18	59
Totals	91	89	51	32	76	339

REGION 4

District 18 – North Cariboo						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
26	3	16	13	8	7	47
97	85	137	106	114	142	584
Various	16	12	25	23	18	94
Totals	104	165	144	145	167	725

District 19 – Fort George ([1]Service Area 19 – Fort George, [2]Service Area 23 – Nechako, [3]Both)						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
16[2]	19	19	37	40	42	157
27[2]	7	3	3	0	0	13
97[3]	37	8	12	20	19	96
Various[3]	56	3	8	17	22	106
Totals	119	33	60	77	83	372

District 20 – Robson						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
5	0	32	30	36	89	187
16	84	69	44	100	108	405
Various	1	4	4	10	25	44
Totals	85	105	78	146	222	636

District 21 – South Peace						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
2	54	37	37	69	42	239
29	56	19	14	35	18	142
49	26	23	31	32	17	129
52	12	13	17	27	9	78
97	271	147	130	277	285	1110
Various	95	27	75	52	39	288
Totals	514	266	304	492	410	1986

District 22 – North Peace						
Highway	**1995**	**1996***	**1997**	**1998**	**1999**	**Totals**
29	17	0	10	6	3	36
97	34	0	8	17	45	104
Various	58	0	15	8	28	109
Totals	109	0	33	31	76	249

* The 1996 WARS reports for District 22 were accidently lost.

REGION 5

District 25 – Bulkley-Lakes ([1]Service Area 24 – Lakes, [2]Service Area 25 - Bulkley-Nass, [3]Both)						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
16[3]	73	78	63	68	84	366
35[1]	8	6	0	4	4	22
37[2]	23	17	22	5	24	91
37A[2]	20	9	1	0	3	33
Various[3]	30	17	11	12	8	78
Totals	154	127	97	89	123	590

District 26 – Skeena ([1]Service Area 26 – Skeena, [2]Service Area 27 – North Coast, [3]Both)						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
16[3]	14	10	90	81	44	239
37[1]	4	14	22	2	15	57
Various[3]	14	7	7	6	19	53
Totals	32	31	119	89	78	349

District 28 – Stikine						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
37	13	4	1	4	8	30
Various	0	0	0	0	7	7
Totals	13	4	1	4	15	37

REGION 6

District 1 – South Island						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
1	55	77	102	102	87	425
1A	0	0	4	0	0	4
14	25	25	29	34	25	138
17	27	7	11	9	5	59
18	0	0	8	13	19	40
Various	244	166	118	139	176	843
Totals	351	275	272	297	312	1507

District 2 – Central Island						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
1	7	18	15	17	12	69
4	22	21	18	7	12	80
18	0	0	3	3	1	7
19	35	89	109	83	115	431
19A	N/A	N/A	8	1	14	23
Various	66	82	89	157	148	542
Totals	130	210	242	268	302	1152

District 3 – North Island						
Highway	**1995**	**1996**	**1997**	**1998**	**1999**	**Totals**
19	117	125	118	164	190	714
28	11	5	4	8	8	36
Various	124	124	111	141	173	673
Totals	252	254	233	313	371	1423

WILDLIFE SPECIES ACCIDENT SUMMARIES

Species Comparisons

During 1999 approximately 80% of the wildlife-vehicle accidents recorded on B.C. numbered highways involved deer. Of the remaining reported accidents; moose were involved in over 8%, bears were involved in over 3% each, elk were involved in over 2%, coyotes were involved in under 2%, and all other wild animals, ranging from badgers to wolves, made up the additional 5% (Table 6). The entire record for the 4846 wild animals of known species reported for all regions and districts is listed in Table 7. Comparisons between 1995 and 1999 accidents are shown in Table 8.

Table 6. Wildlife Accidents (1999)

Species	Number	%
badger	2	0.04
bear	165	3.38
beaver	9	0.18
bobcat	2	0.04
cougar	4	0.08
coyote	89	1.82
deer	3896	79.71
eagle	1	0.02
elk	128	2.62
fox	12	0.25
horned owl	4	0.08
moose	411	8.41
muskrat	1	0.02
otter	2	0.04
porcupine	59	1.21
rabbit	2	0.04
raccoon	47	0.96
sheep	9	0.18
wolf	3	0.06
other	42	0.86
Total	4888	100.00

Table 7. Wildlife Accidents by Province, Regional and District by Known Species (1999)

A) Provincial Distribution

		all species	badger	bear	beaver	bobcat	cougar	coyote	deer	eagle	elk	fox	horned owl	moose	muskrat	otter	porcupine	rabbit	raccoon	sheep	wolf
Totals		4846	2	165	9	2	4	90	3896	1	127	12	4	411	1	2	59	2	47	9	3

B) Regional Distribution

Region		all species	badger	bear	beaver	bobcat	cougar	coyote	deer	eagle	elk	fox	horned owl	moose	muskrat	otter	porcupine	rabbit	raccoon	sheep	wolf
1		201	0	15	1	2	0	27	138	0	1	1	0	1	0	0	0	2	13	0	0
2		1017	1	51	2	0	0	26	879	0	1	3	4	44	0	0	4	0	1	1	0
3		1485	1	40	1	0	0	15	1290	0	107	2	0	19	1	0	0	0	1	8	0
4		953	0	23	0	0	0	18	623	0	11	2	0	264	0	0	11	0	0	0	1
5		217	0	22	3	0	0	3	57	0	0	4	0	81	0	1	44	0	0	0	2
6		973	0	14	2	0	4	0	909	1	8	0	0	2	0	1	0	0	32	0	0

C) District Distribution

Region	District	all species	badger	bear	beaver	bobcat	cougar	coyote	deer	eagle	elk	fox	horned owl	moose	muskrat	otter	porcupine	rabbit	raccoon	sheep	wolf
1	4	89	0	5	0	0	0	1	80	0	1	0	0	1	0	0	0	0	1	0	0
1	6	36	0	0	0	0	0	18	8	0	0	0	0	0	0	0	0	1	11	0	0
1	7	74	0	10	1	2	0	8	50	0	0	1	0	0	0	0	0	1	1	0	0
2	8	287	0	4	1	0	0	3	278	0	1	0	0	0	0	0	0	0	0	0	0
2	13	215	0	15	0	0	0	6	190	0	0	0	1	2	0	0	1	0	0	0	0
2	14	90	1	6	0	0	0	9	61	0	0	0	3	7	0	0	2	0	1	0	0
2	15	139	0	13	1	0	0	6	117	0	0	0	0	0	0	0	1	0	0	1	0
2	17	286	0	13	0	0	0	2	233	0	0	3	0	35	0	0	0	0	0	0	0
3	9	523	0	5	0	0	0	5	508	0	3	0	0	2	0	0	0	0	0	0	0
3	10	305	0	19	0	0	0	3	261	0	12	1	0	7	0	0	0	0	1	1	0
3	11	584	1	9	0	0	0	7	468	0	87	1	0	7	0	0	0	0	0	4	0
3	12	73	0	7	1	0	0	0	53	0	5	0	0	3	1	0	0	0	0	3	0
4	18	166	0	3	0	0	0	1	144	0	0	0	0	18	0	0	0	0	0	0	0
4	19	83	0	3	0	0	0	2	16	0	2	0	0	54	0	0	6	0	0	0	0
4	20	221	0	15	0	0	0	6	116	0	1	0	0	81	0	0	1	0	0	0	1
4	21	407	0	1	0	0	0	9	281	0	8	0	0	104	0	0	4	0	0	0	0
4	22	76	0	1	0	0	0	0	66	0	0	2	0	7	0	0	0	0	0	0	0
5	25	128	0	20	2	0	0	1	35	0	0	2	0	53	0	0	14	0	0	0	1
5	26	76	0	1	1	0	0	2	20	0	0	1	0	20	0	1	29	0	0	0	1
5	28	13	0	1	0	0	0	0	2	0	0	1	0	8	0	0	1	0	0	0	0
6	1	310	0	1	1	0	0	0	305	0	1	0	0	1	0	0	0	0	1	0	0
6	2	301	0	4	0	0	3	0	287	0	2	0	0	0	0	0	0	0	5	0	0
6	3	362	0	9	1	0	1	0	317	1	5	0	0	1	0	1	0	0	26	0	0

Table 8. Total Number of Animals Killed by Known Species (1995 to 1999)

Year	1995	1996	1997	1998	1999	Totals
all known species	**4,764**	**3,853**	**3,650**	**4,559**	**4846**	**21,672**
badger	0	0	0	1	2	**3**
bear	108	104	88	139	165	**604**
beaver	13	7	13	9	9	**51**
bobcat	5	5	0	1	2	**13**
caribou	9	4	2	3	0	**18**
cougar	1	3	2	0	4	**10**
coyote	129	97	90	134	89	**539**
deer	3,917	3,148	3,017	3,683	3,896	**17,661**
eagle	0	0	0	1	1	**2**
elk	93	104	77	103	128	**505**
fox	3	5	6	5	12	**31**
horned owl	0	0	1	3	4	**8**
lynx	1	0	0	0	0	**1**
marmot	2	0	0	0	0	**2**
marten	3	1	0	0	0	**4**
moose	367	283	250	361	411	**1,672**
muskrat	0	1	2	1	1	**5**
otter	1	0	0	0	2	**3**
porcupine	76	33	67	61	59	**296**
possum	5	3	0	0	0	**8**
rabbit	3	0	4	2	2	**11**
raccoon	5	40	21	36	47	**149**
skunk	8	3	1	1	0	**13**
sheep	10	10	6	13	9	**48**
wolf	5	2	3	2	3	**15**

Accident Rates by Species

Trends appear when the monthly distribution of wildlife-vehicle accidents for all species are compared for each Region (Table 9). When all records for the period between 1989 and 1998 are compared, the accident rate for all Regions peaks in May and November (Figure 3). Deer represent approximately 80% of the wildlife killed on provincial highways. Consequently, the general Provincial trend parallels the trend found for deer in all Regions. However, the high numbers of deer killed obscures the trends for other species (Figure 4).

Table 9. Total Monthly Distribution of Wildlife Accidents by Known Species (1990 to 1999)

	January	February	March	April	May	June	July	August	September	October	November	December	Totals
all species	3257	2894	3145	3272	3862	3495	3793	3662	3346	3912	4158	3293	**42104**
deer	2414	2385	2836	2941	3335	2868	3051	2772	2446	3229	3596	2448	**34321**
bear	3	4	8	15	72	87	132	185	290	177	44	7	**1024**
beaver	3	4	7	12	18	11	6	12	10	11	3	1	**98**
bobcat	9	4	3	4	4	0	3	2	2	2	2	1	**36**
cougar	1	1	4	1	1	2	2	0	0	0	5	1	**18**
coyote	99	94	63	59	56	50	85	117	160	134	89	81	**1090**
elk	145	81	72	60	81	75	45	47	37	41	93	119	**896**
fox	2	8	5	1	3	2	3	8	2	9	5	3	**51**
moose	544	266	120	130	122	251	227	200	145	159	290	517	**2971**
porcupine	2	7	4	28	129	106	197	268	198	79	19	3	**1040**
raccoon	8	7	4	1	14	14	14	26	23	39	16	17	**183**
sheep	9	14	9	6	3	8	3	8	11	5	12	16	**104**
skunk	0	2	0	2	0	3	6	3	7	2	0	0	**25**
wolf	0	3	2	2	0	2	1	0	2	3	2	5	**22**

Figure 3. Total Monthly Wildlife Accidents by Species

(1990 - 1999)

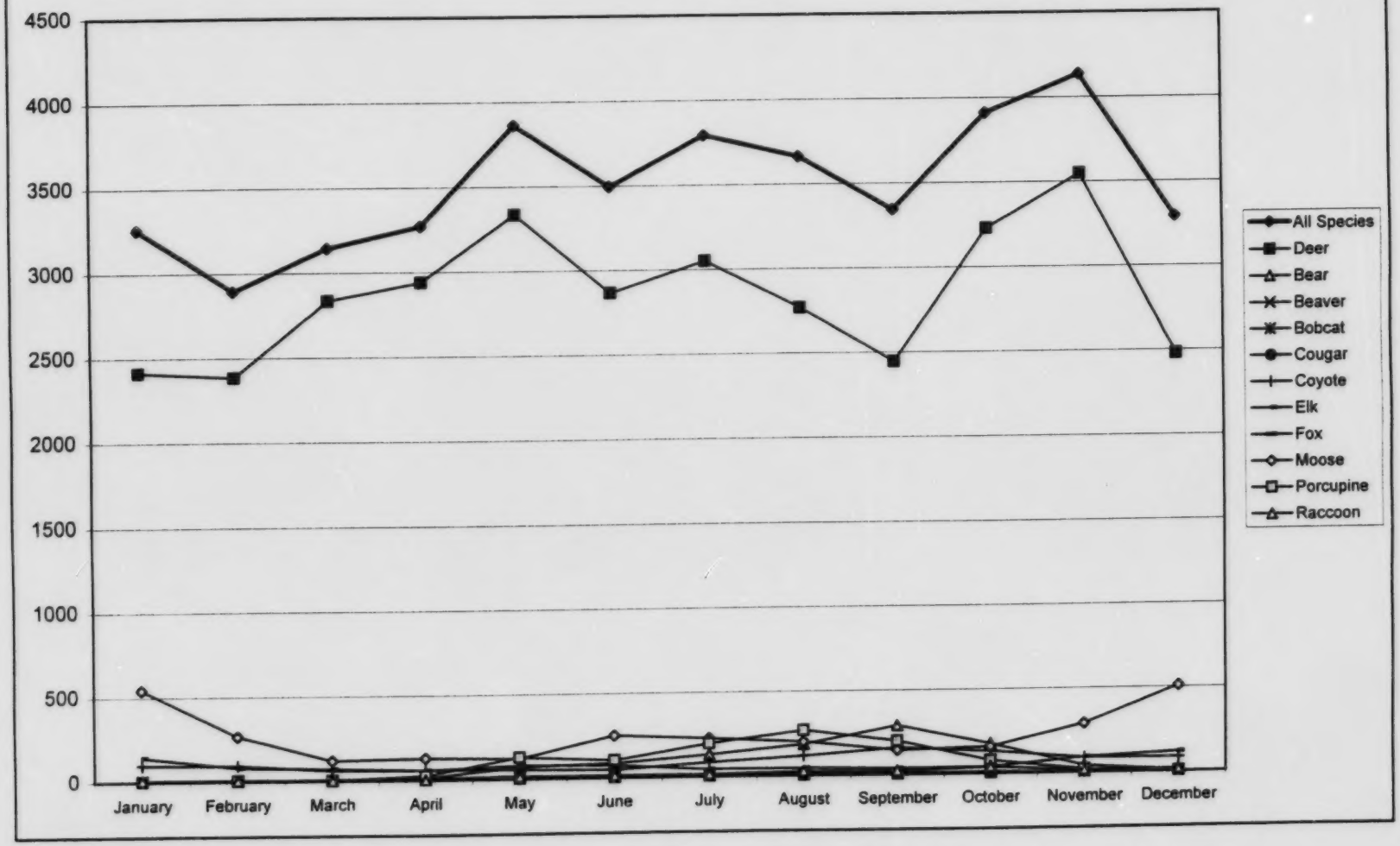
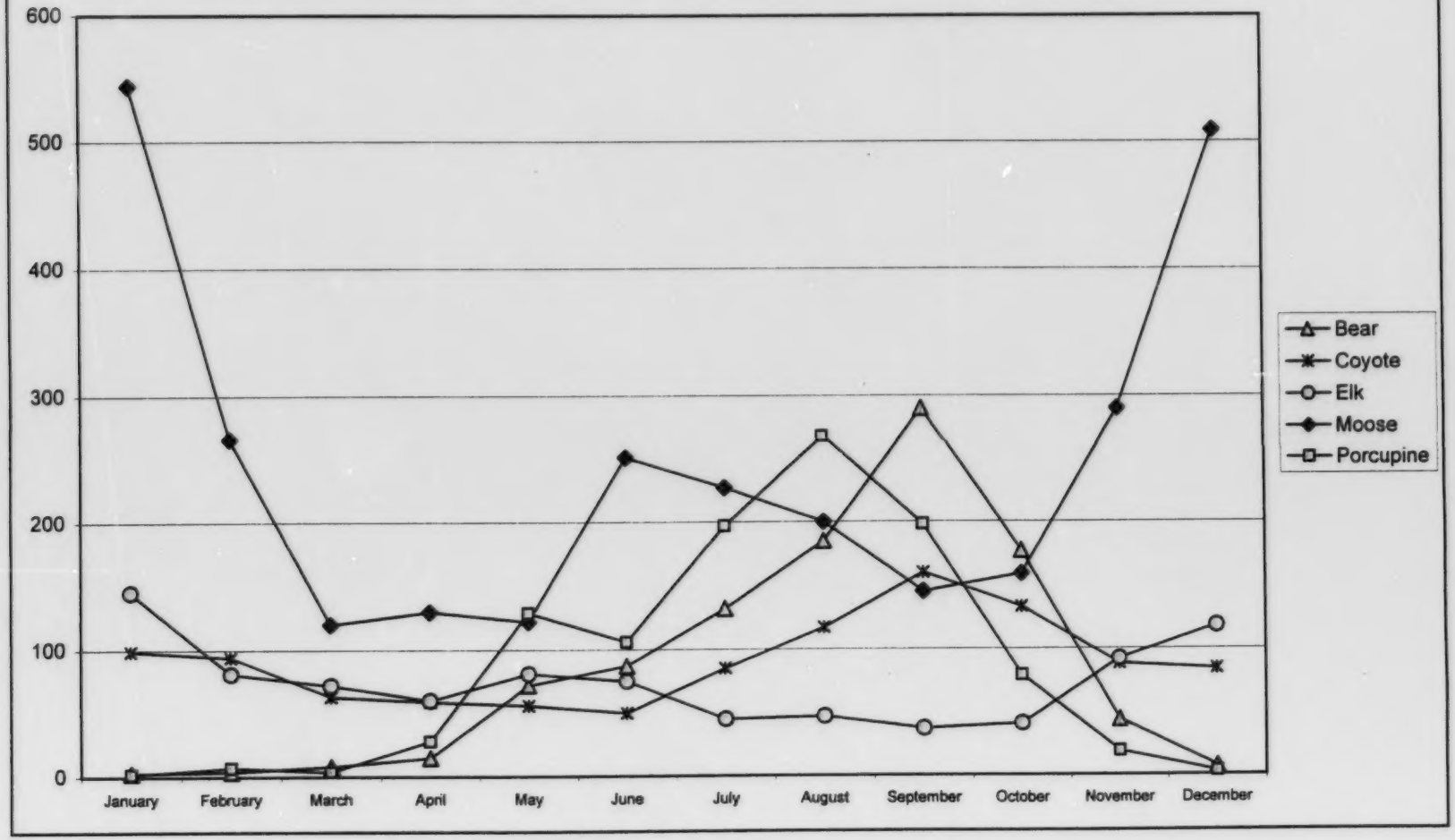


Figure 4. Total Monthly Bear, Coyote, Elk, Moose and Porcupine Accidents

(1990 - 1999)



When deer accidents are evaluated by season and gender, female deer are involved in most accidents and these occur between March and May, and between October and November (Figure 5). The majority of bucks are killed between May and July and in November.

The fall peak for both does and bucks is most likely related to the rutting season. When deer accidents are evaluated by age, adult deer are involved in most accidents (Figure 6). Young deer are mostly killed between May and November. This may be related to natural reproduction and cohort survival rates and the fact that adult deer vastly outnumber young deer at all times.

When the accident patterns for moose, elk, bear, coyote and porcupine are examined, it is apparent that the monthly accident distributions vary by species (Figure 4).

The majority of moose are killed between October and March (Figures 7 and 8). This coincides with times of high snowfall in Regions 2, 3 and 4, when moose are found alongside highways that are actively kept cleared of snow. An accident peak is also observed in June, this may be due to pregnant cows moving to calving grounds in the early summer or licking salt on or along the highway.

Bear-related motor vehicle accidents occur more frequently in September (Figures 9 and 10). This peak coincides with the end of summer and the depletion of the bears' natural food sources in more remote locations.[1] At this time, bears appear to migrate toward food sources located near human settlements. Consequently, the number of bear-motor vehicle accidents increases at the same time bear-human conflicts also increase. Although common belief suggests all bears hibernate uninterrupted during the winter months, WARS data shows that a small number of bears are killed between November and March. Apparently, on warmer winter days, some larger male bears awake from hibernation and roam about.

Lesser numbers of elk are reported. The pattern for elk-related motor vehicle accidents is less established, however a small peak occurs between October and March (Figures 11 and 12). Elk appear to be influenced by the same snow conditions which affect moose.

Coyote accidents peak at about the same time bear accidents do (Figures 13 and 14). Coyotes may be following bears onto roads in order to benefit from the remains of the animals bears kill or the remains that bears find on the road or in the road right-of-way.[1]

Porcupine accidents exhibit two peaks, the first, a small peak in May, followed by a large peak in August. Although porcupines are not the largest animals found on provincial highways, they constitute a safety hazard as their quills can puncture motor vehicle tires and increase the severity of an accident.[2]

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[1] Austin, M., 1999, Personal Communication, Large Carnivore Specialist, B.C. Ministry of Environment, Lands and Parks (MELP), Wildlife Branch, Research and Conservation Section, Victoria, B.C.

[2] Zacharias, C., 1999, Personal Communication, Environmental Services Assistant, B.C. Ministry of Transportation and Highways (MoTH), Engineering Branch, Environmental Services Section, Victoria, B.C.

Figure 5. Total Monthly Deer Accidents by Gender

(1990 - 1999)

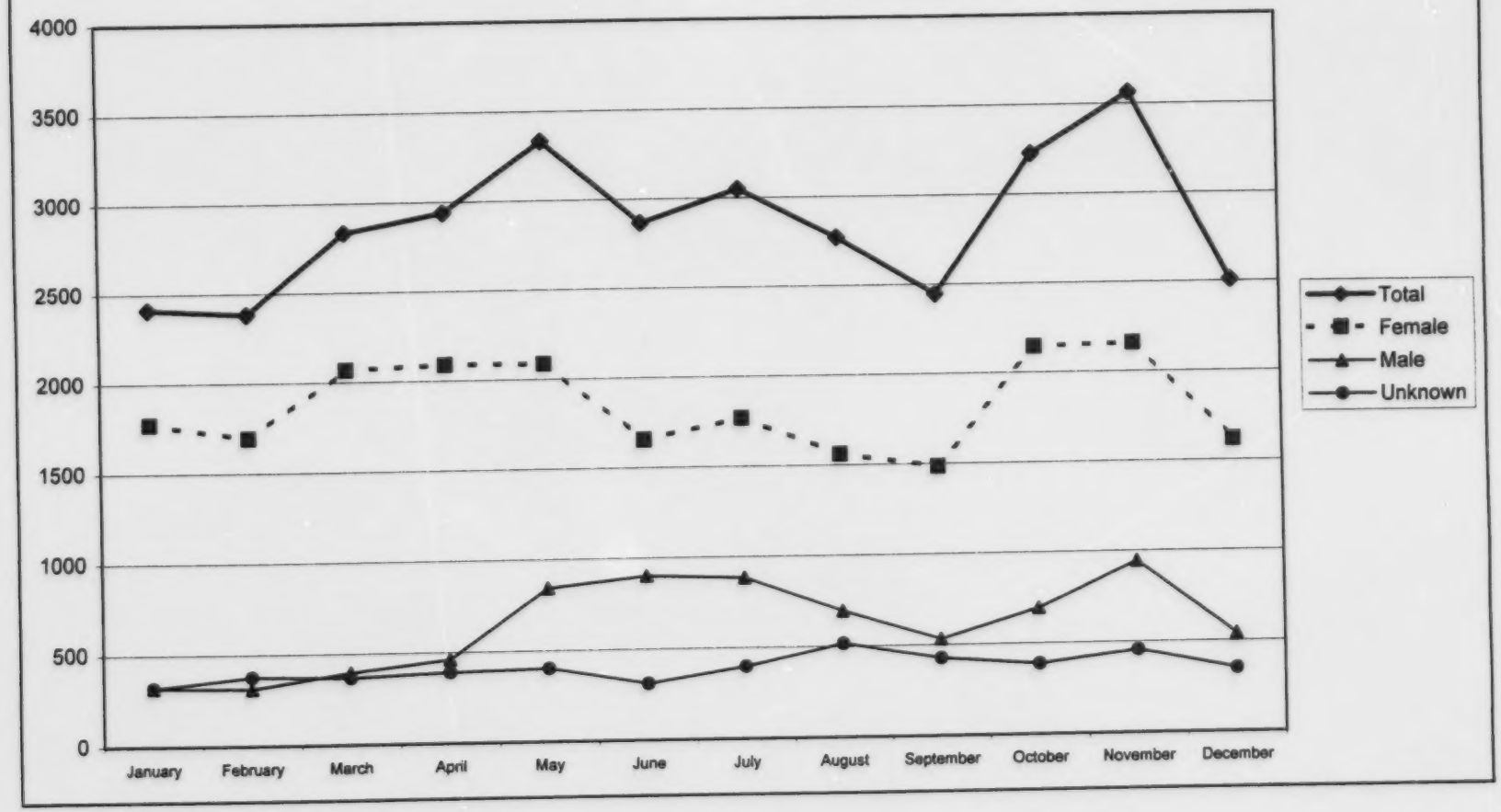
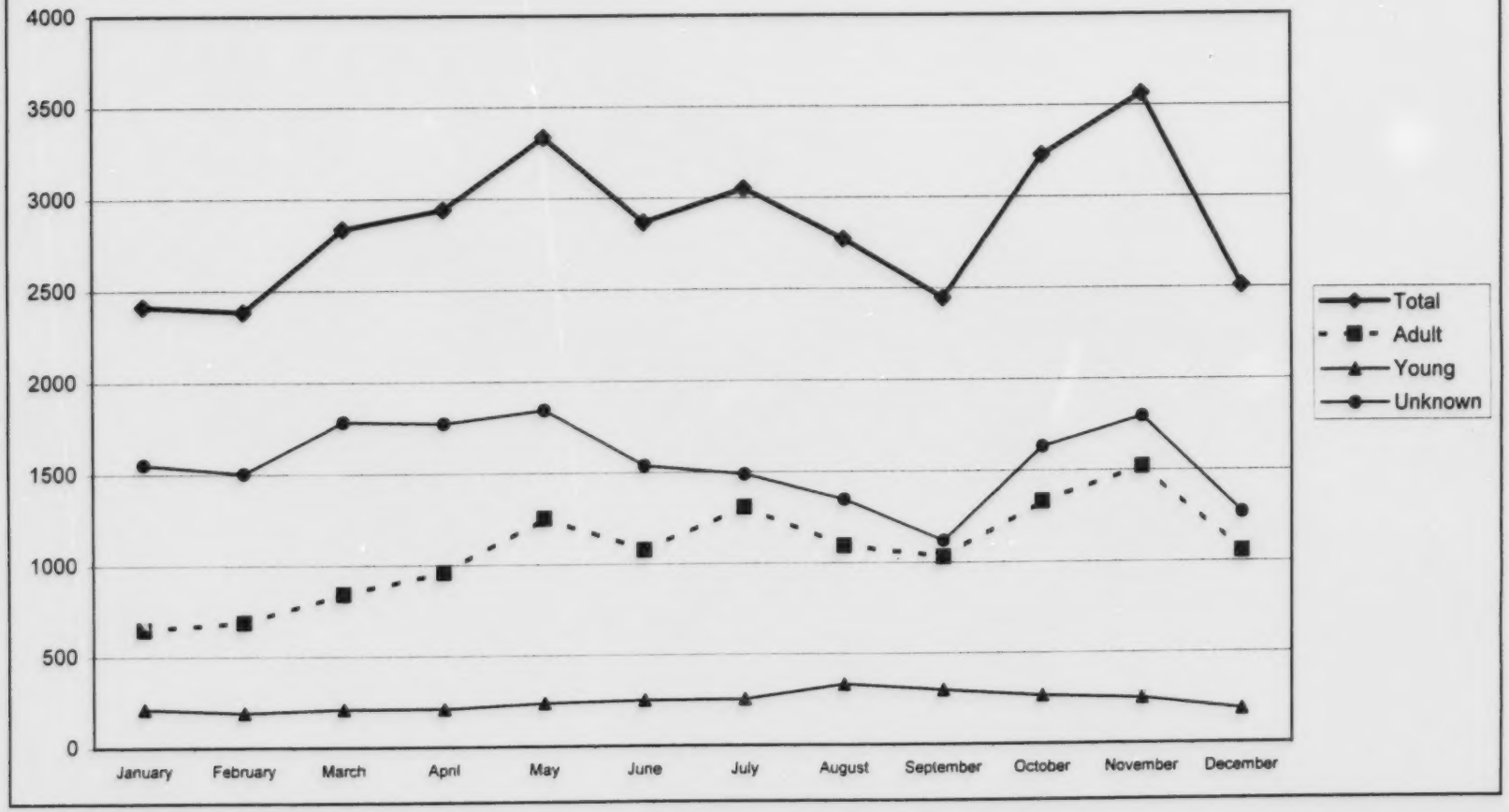


Figure 6. Total Monthly Deer Accidents by Age

(1990 - 1999)



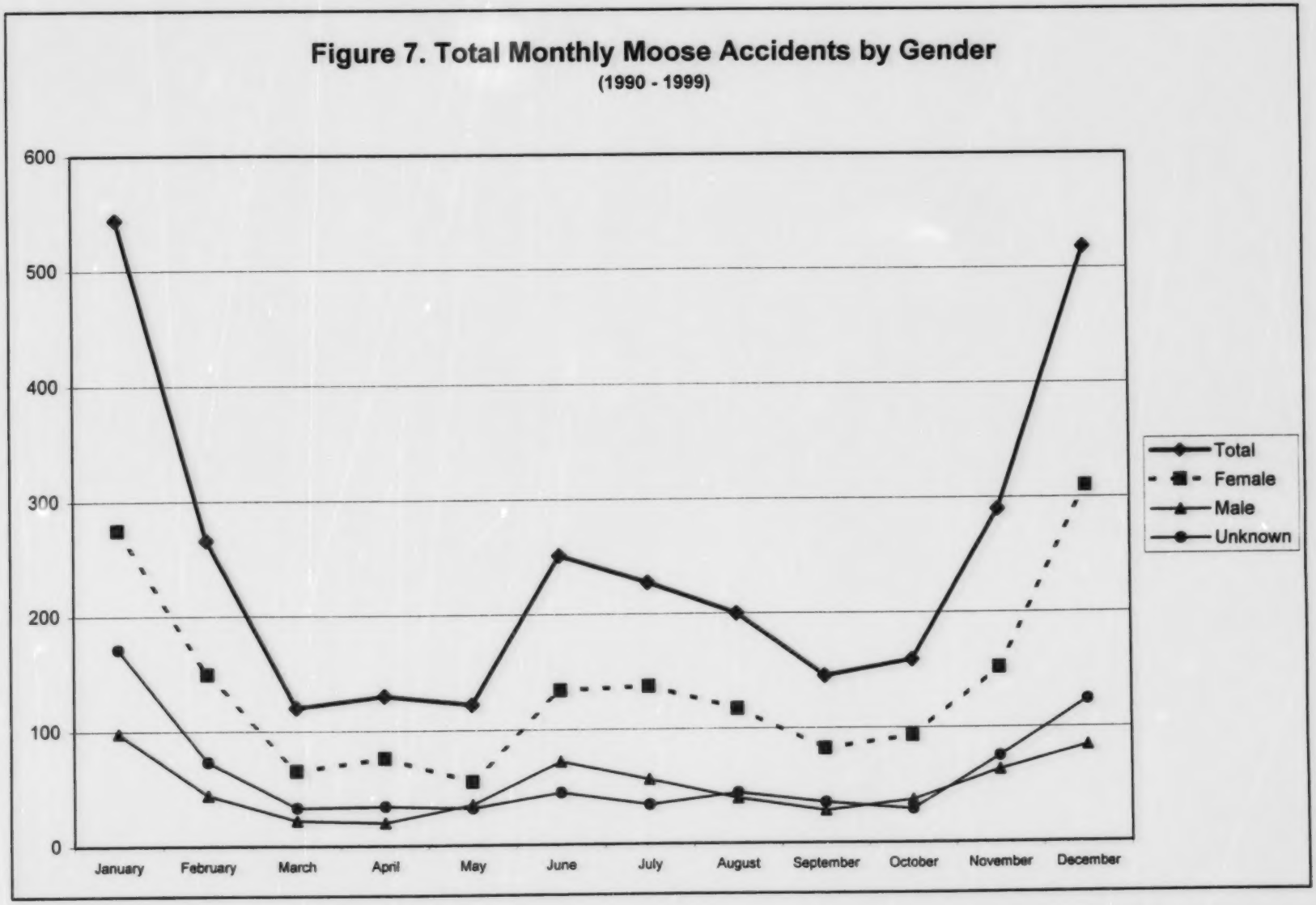


Figure 7. Total Monthly Moose Accidents by Gender
(1990 - 1999)
600
500
400
300
200
100
0
January
February
March
April
May
June
July
August
September
October
November
December
Total
Female
Male
Unknown

Figure 8. Total Monthly Moose Accidents by Age

(1990 - 1999)

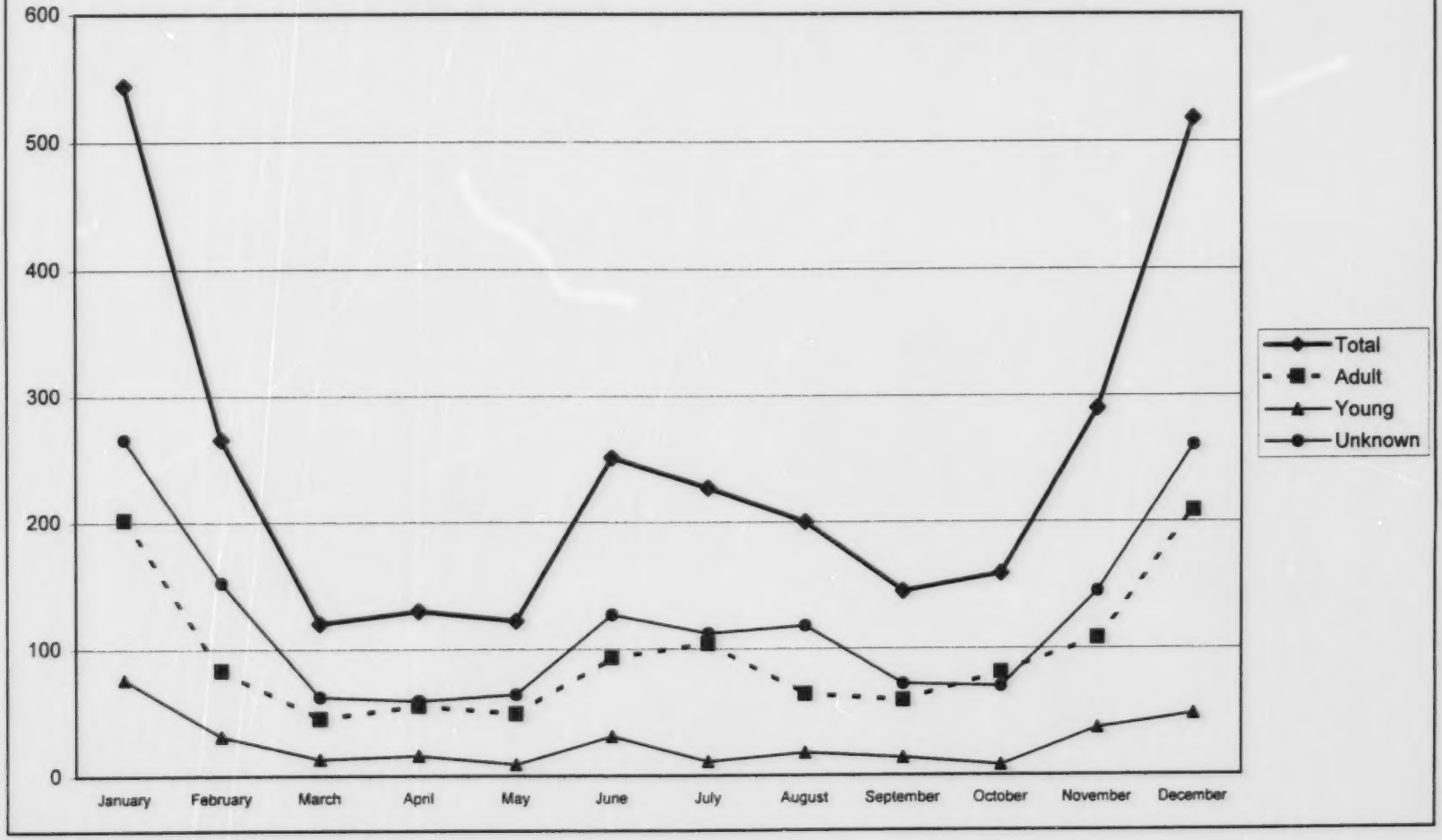


Figure 9. Total Monthly Bear Accidents by Gender

(1990 - 1999)

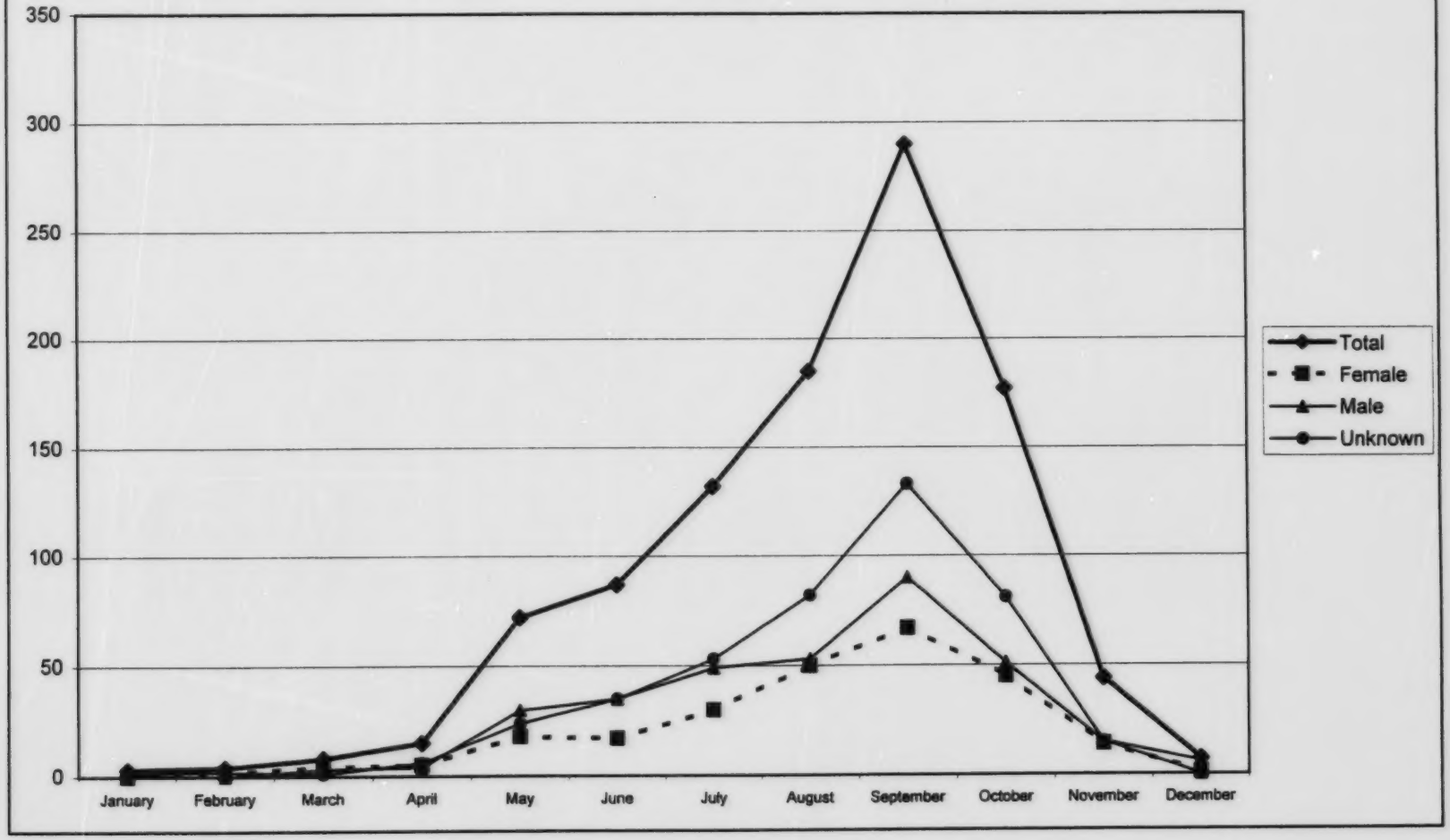


Figure 10. Total Monthly Bear Accidents by Age

(1990 - 1999)

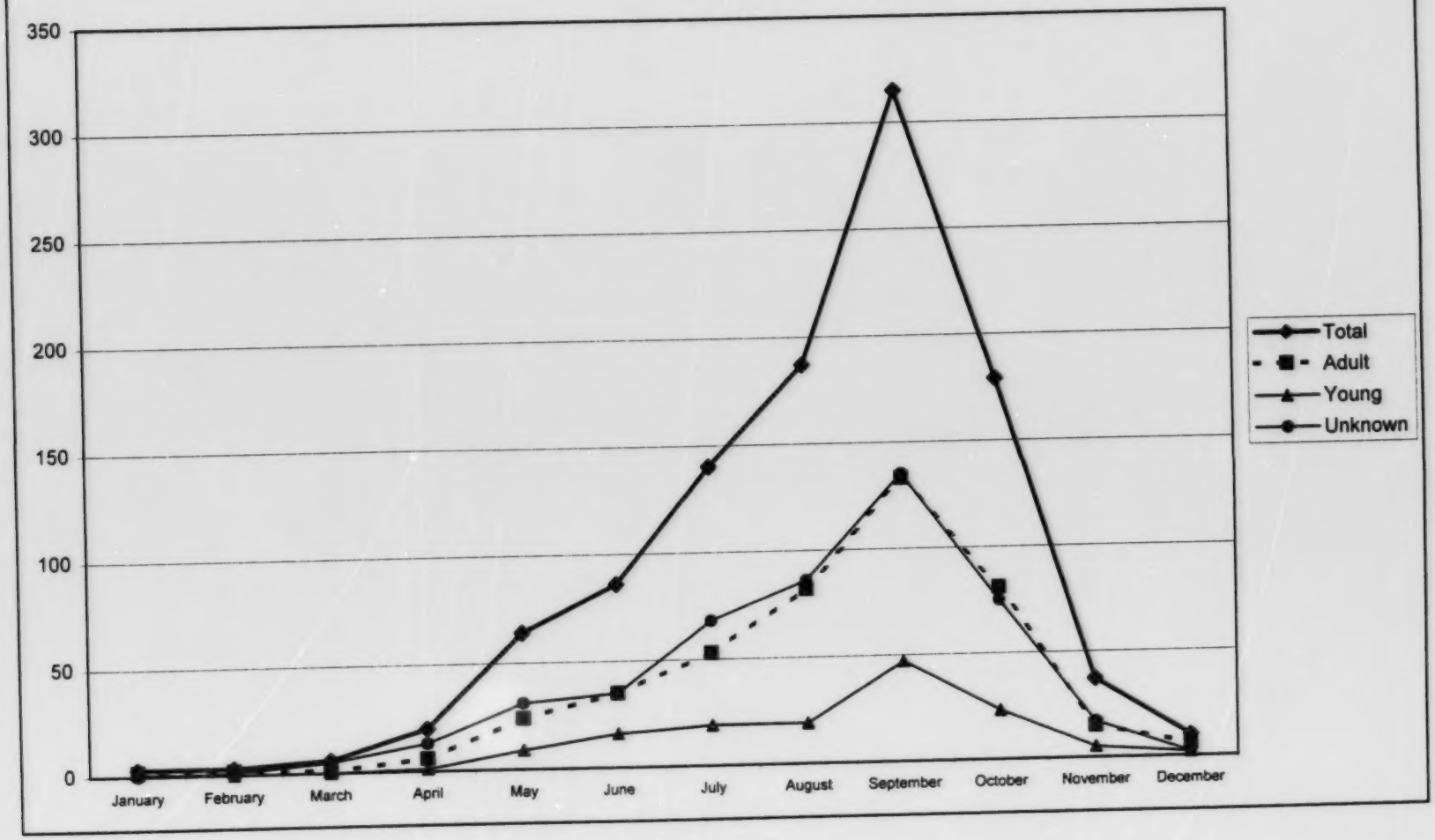


Figure 11. Total Monthly Elk Accidents by Gender
(1990 - 1999)

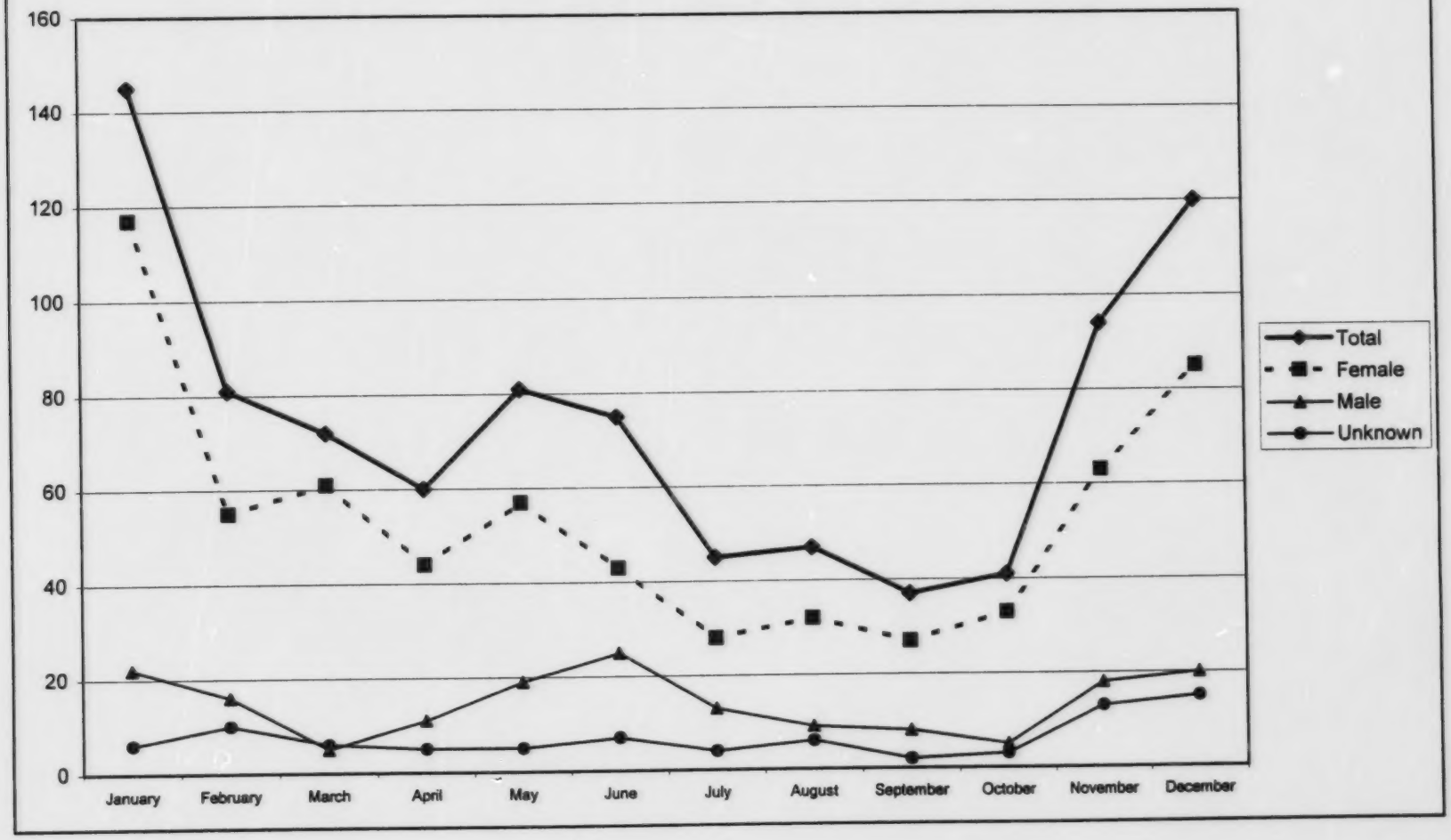


Figure 12. Total Monthly Elk Accidents by Age

(1990 - 1999)

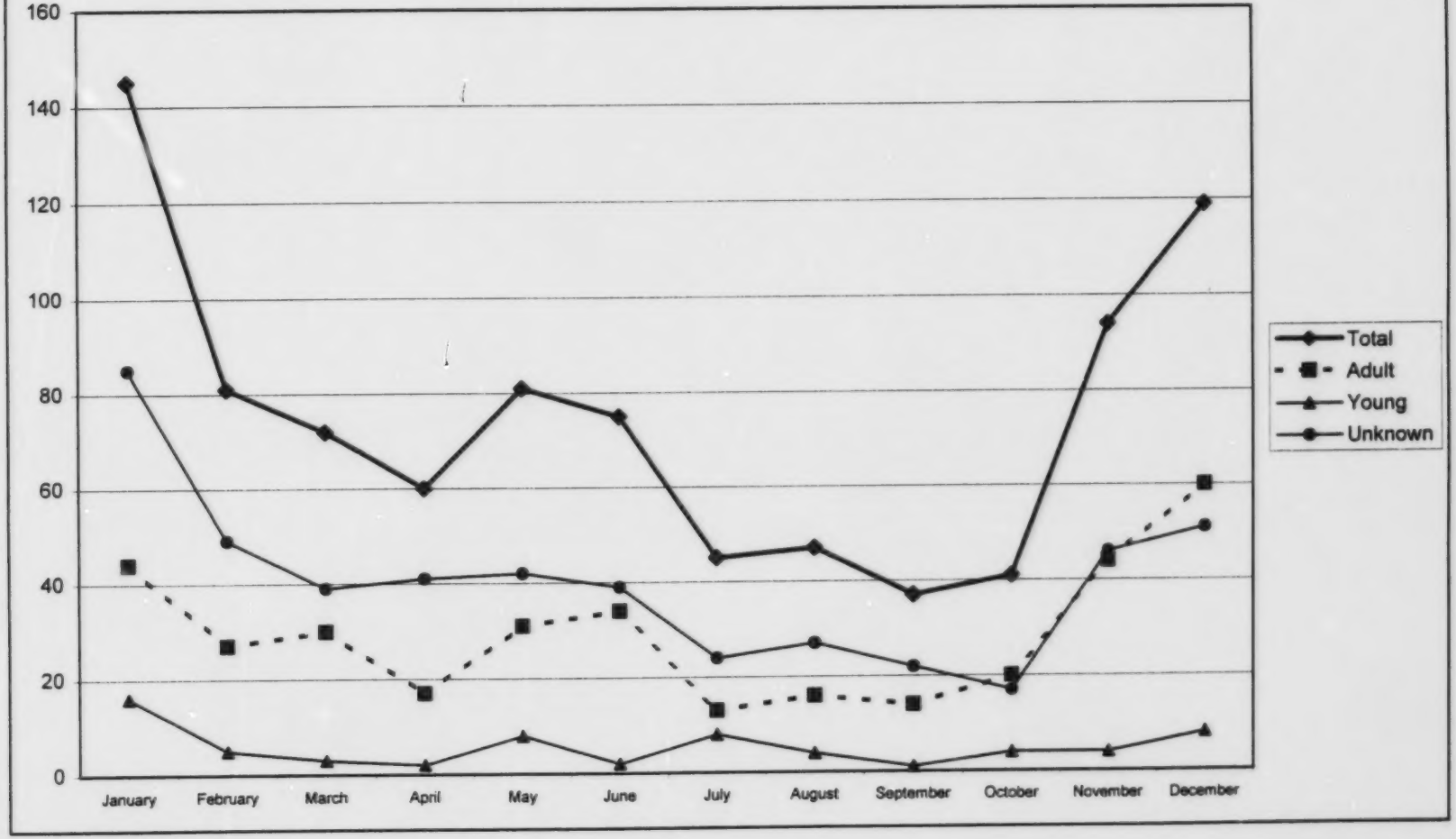


Figure 13. Total Monthly Coyote Accidents by Gender
(1990 - 1999)

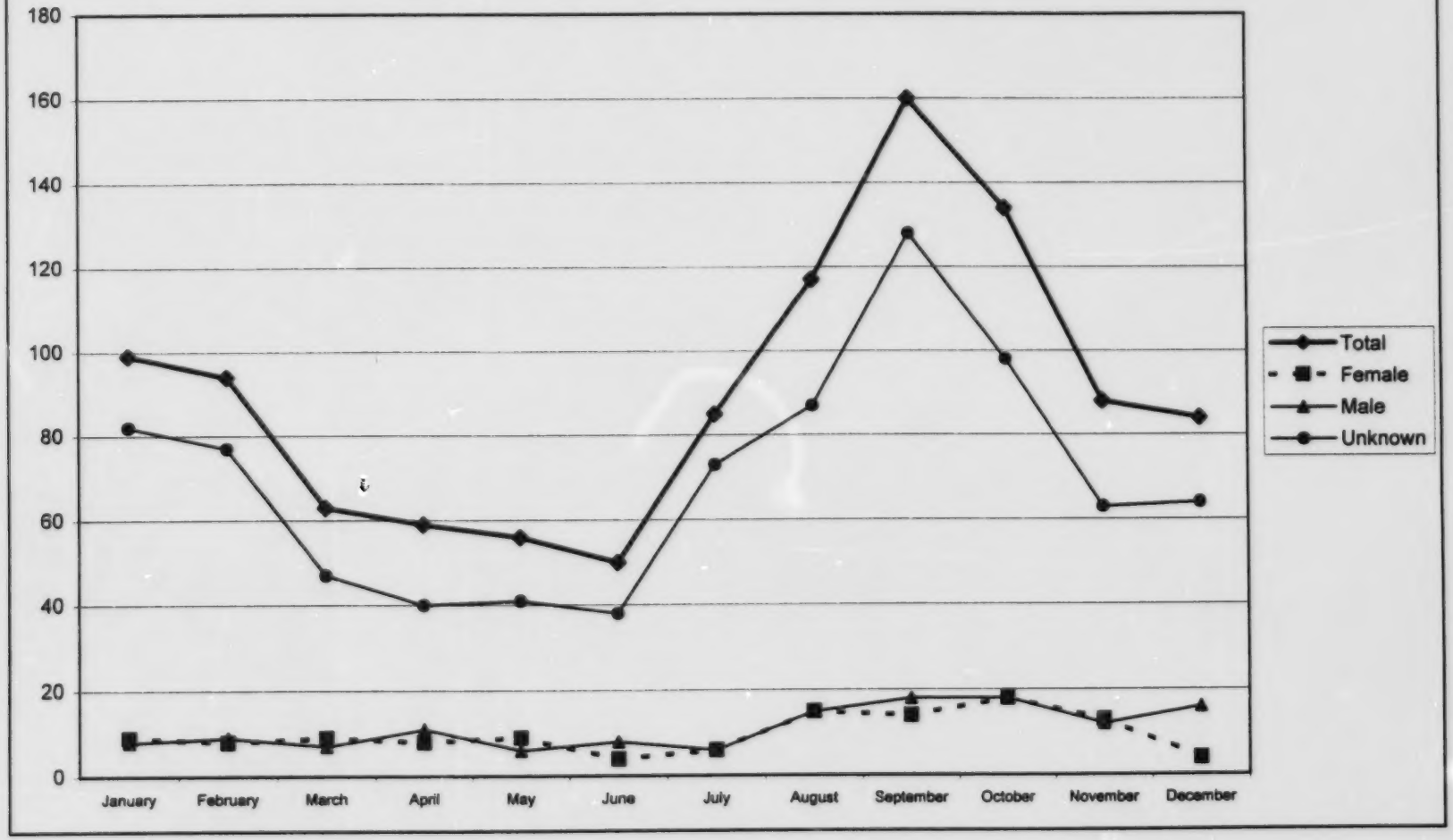
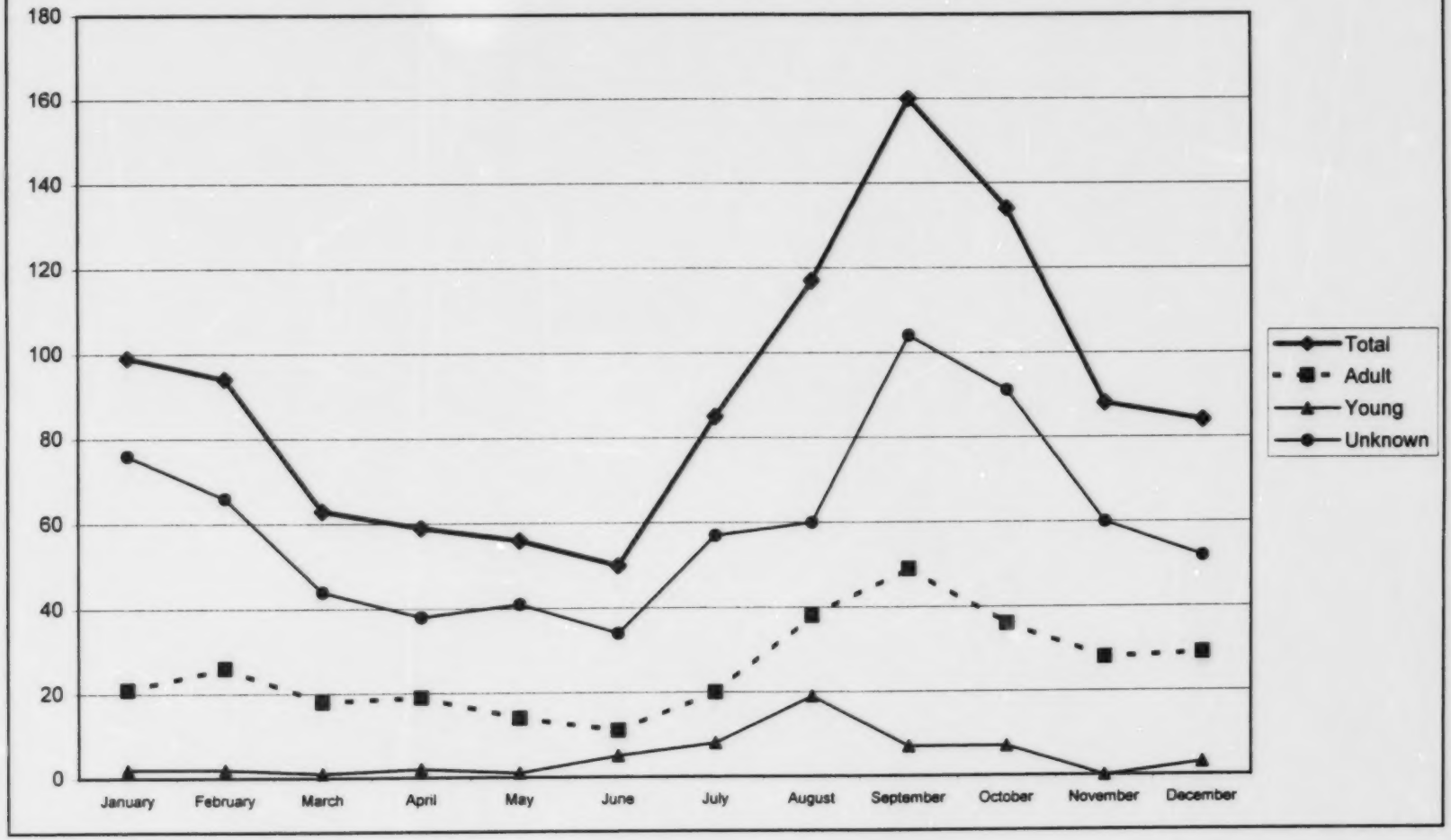


Figure 14. Total Monthly Coyote Accidents by Age
(1990 - 1999)



WILDLIFE VEHICLE ACCIDENT MITIGATION METHODS

Overview

Methods utilized by the Ministry of Transportation and Highways to reduce wildlife vehicle accidents are pursued with multi-faceted objectives. The Ministry strives to reduce, and ultimately eliminate human and wildlife deaths and injuries, and motor vehicle and property damage; as well as increase public awareness and ensure that mitigation techniques are cost effective. The mitigation methods currently employed by this Ministry include:

- habitat modification,
- exclusion fencing,
- wildlife reflectors, and
- wildlife warning signs.

Habitat Modification

Highways and right-of-ways are intrinsically attractive to wildlife. Highways are often located in areas where wildlife naturally congregate, especially during winter, such as valley bottoms and riversides. Also many ungulates prefer to travel along open areas close to cover, which represents the typical highway and right-of-way situation.

Historically, the Ministry used a variety of agricultural type seed blends to reseed right-of-way areas, after road construction, to prevent soil erosion. Although effective for their intended purpose, some seed blends, particularly those containing legumes such as clovers and alfalfa, appear to attract animals to the roadside.

In order to deter this, the Ministry has adjusted its seed mixes in problem areas to remove the plant types which are known to attract animals. The Ministry is also examining the potential of non-toxic, biodegradable systemic fertilizers and repellents which make roadside plants taste and smell less desirable to ungulates.

Exclusion Fencing

Exclusion fencing is the most effective means of keeping wildlife off highway right-of-ways. The Ministry's experience with 2.4 m high fencing on both sides of right-of-ways show that it is 97-99% effective in preventing wildlife-vehicle accidents.

Fencing can be installed as a primary deterrent or in conjunction with other structures such as wildlife overpasses, underpasses and one way gates. This type of mitigation is expensive. It costs between $40,000 to $80,000 per km to fence both sides of a highway. Construction costs vary greatly due to differences in terrain and locations. Currently over 320 kilometres of fencing have been installed in Region Two on the Coquihalla Highway (Highway 5), the Okanagan Connector Freeway, and Highway 97 (Table 10).

Table 10. Locations of Wildlife Exclusion Fencing

Total Fencing Length on British Columbia Highways = 320.44 km
(This figure includes fencing located on both sides of highways)

COQUIHALLA HIGHWAY	DISTANCE (KM)	COMPLETION DATE
Dry Gulch – Henning Bridge	5.99	July 1994
Henning Bridge – Juliet Creek	9.23	May 1993
Juliet Creek Bridge – Brodie Bridge	9.35	Oct 1993
Brodie Bridge – Kingsvale Bridge	8.72	March 1997
Upper Clapperton Creek – Desmond Lake	8.3	April 1990
Desmond Lake – Meadow Creek Road	8.6	July 1988
Meadow Creek Road – Chuwhels Mountain Road	8.2	Sept 1987
Chuwhels Mountain Overpass – Connolly Lake Overpass	5.2	June 1993
Connolly Lake Overpass – Inks Lake Interchange	7.6	May 1994
Total Fencing (includes both sides of highway)	**140.44 km**	

OKANAGAN CONNECTOR FREEWAY	DISTANCE (KM)	COMPLETION DATE
Aspen Grove to Drought Hill Interchange	82	Fall 1990
Total Fencing (includes both sides of highway)	**164 km**	

HIGHWAY 97*	DISTANCE (KM)	COMPLETION DATE
Bentley Road to Deep Creek	15	March 1999
Total Fencing (one side of highway)	**15 km**	

* Fencing materials provided by MoTH; ICBC contributed $128,000, construction labour and on-going maintenance provided by members of the Summerland Sportsmens' Association and the Peachland Sportmens' Association, affiliated associations of the B.C. Wildlife Federation.

The general locations of wildlife exclusion fence installations are shown on the Maintenance Contract Area maps (Appendix A). Wildlife exclusion fencing has proven very effective in reducing wildlife accidents on the Coquihalla Freeway (Highway 5) located between Hope and Merritt. On the 35 km portion of the Coquihalla Freeway, between Dry Gulch Bridge and Kingsvale Bridge, wildlife exclusion fencing reduced wildlife accidents by 100%. The number of wildlife accidents declined from 74, in the 1989 to 1993 period, to 0, in the 1994 to 1998 period.

Since the wildlife exclusion fencing was installed on the Coquihalla Connector Freeway (Highway 97C) in 1990 to 1998, no wildlife accidents have been recorded in either the westbound or eastbound lanes of the highway where the fence is located.

On Highway 97, between Peachland and Summerland, after a 21 kilometre wildlife exclusion fence was constructed on the west side of the highway, the rate of wild animal accidents/km/year dropped by over 93%. From 1979 to 1998 the annual accident rate was 1.93 accidents/km/year. In 1999, after the fence was completed, the accident rate dropped to 0.13 accidents/km/year.

Wildlife Warning Signs

The Ministry's standard leaping stag wildlife warning signs are the least expensive form of wildlife-vehicle accident mitigation measure at approximately $150 per sign. Unfortunately, it appears that there is a low correlation between the reduction of accidents and the presence of wildlife warning signs. Swedish research has found that the signs were not noticed by 60% of motorists.

Wildlife Reflectors

The Ministry has been installing wildlife reflectors since the late 1980's as part of its continued effort to reduce wildlife-related accidents. Wildlife reflectors are prisms mounted on posts and installed along the sides of the highway as a means of deterring animals from entering the highway when vehicles are present. At night, as the headlights of an approaching vehicle strike the reflectors they reflect beams of light at ninety-degree angles to the roadway. The reflected light catches the attention of animals and distracts them long enough to delay their movement onto the road until the vehicle has passed. Reflectors cost approximately $10,000/km to install along both sides of a highway. To date, reflectors have been installed on either one side or both sides of 151.8 kilometres of highway. The general locations of the reflector installations are shown on the Maintenance Contract Area maps (Appendix A). Reflectors have been extensively used in Region 3 (Table 11) along highways prone to high numbers of deer-related accidents.

The success of wildlife reflectors for reducing wildlife accidents has been the object of much discussion. Although the following results were not observed as part of a controlled scientific experiment and the periods of observation are short, the most notable successful installations are located on Highway 3 in District 9, and on Highway 95A in District 11.

- Between 1991 and 1994, one 9.37 kilometre section of Highway 3 in District 9 recorded 24.75 deer accidents per year. Wildlife reflectors were installed in early 1995. Between 1995 and 1998, an average of 19.0 deer accidents per year were recorded for this section of highway. The accident rate dropped from 2.6 accidents/km/year to 2.0 accidents/km/year. This represented a 23% decrease. In 1999, the deer accident rate fell to 1.6 accidents/km.

- Between 1991 and 1994, one 6.62 kilometre section of Highway 95A in District 11 recorded eight deer accidents per year. After the installation of wildlife reflectors in 1995, the number of deer accidents between 1995 and 1998 dropped to an average of 4.75 per year on this section of road. The accident rate dropped from 1.2 accidents/km/year to 0.6 accidents/km/year. This represented a 40% decrease for the reflectorized stretch of road. However, in 1999, the deer accident rate increased to 3.3 accidents/km.

Based upon the WARS data collected, it is apparent that not all wildlife reflector installations have been successful. Many installations are less than 2 kilometres long, with 17% being 0.5 kilometres or less in length. Short installations make evaluation difficult, as it is easier for animals to travel to the end of the reflectors and cross the highway. Short installations also make the accuracy of reporting accident locations difficult, and thereby, the measurement of the effectiveness of the reflectors.

A more thorough analysis of WARS data is required to determine the long-term effectiveness of wildlife reflectors on provincial highways. There may be many reasons why dramatic fluctuations in the number of accidents occur, including climate, traffic speed and volume, and wildlife movement. In 1999, ICBC provided MoTH with $19,000 to study the effectiveness of wildlife reflectors on a 3.4 km stretch of Highway 5 between Clearwater and Vavenby. Data needs to be collected for at least 2 to 3 years before any conclusive results can be expected.

Accident Occurrences

The effectiveness of wildlife signs and reflectors is dependent on many factors, including sign and reflector condition, weather, driver awareness and attitude, and time of day. ICBC has found that approximately 45% of the animal collisions which occur in the Southern Interior of B.C. occur between 7:00 p.m. and 12:00 p.m. (Table 12).

Table 11. Wildlife Reflector Locations (April 1999)

Region	District	Highway	LKI Segment	Start km	End km	Length (km)	Side of Highway	Installation Date
1	7	3	1305	64.2	66.0	1.8	Both	1999
1	7	3	1305	88.9	90.3	1.4	Both	1999

Region	District	Highway	LKI Segment	Start km	End km	Length (km)	Side of Highway	Installation Date
2	13	97	1115	46.20	56.20	10.00	Both	3/31/95

Region	District	Highway	LKI Segment	Start km	End km	Length (km)	Side of Highway	Installation Date
2	14	5	2000	81.55	82.15	0.60	Northbound	1986/88
2	14	5	2000	85.00	85.20	0.20	Northbound	1986/88
2	14	5	2000	85.40	90.13	4.73	Northbound	1986/88
2	14	5	2000	90.26	91.85	1.59	Northbound	1986/88
2	14	5	2000	91.97	92.05	0.08	Northbound	1986/88
2	14	5	2000	92.43	93.11	0.68	Northbound	1986/88
2	14	5	2000	103.08	103.10	0.02	Northbound	1986/88
2	14	5	2000	104.30	104.42	0.12	Northbound	1986/88
2	14	5	2005	4.74	6.51	1.77	Southbound	1986/88
2	14	5	2005	16.81	19.44	2.63	Southbound	1986/88
2	14	5	2005	19.62	24.49	4.87	Southbound	1986/88
2	14	5	2005	27.38	27.68	0.30	Southbound	1986/88

Region	District	Highway	LKI Segment	Start km	End km	Length (km)	Side of Highway	Installation Date
2	15	5	1760	50.9	52.3	1.4	Both	1995/96 reinstalled to new specifications Sept 1999
2	15	5	1760	52.3	54.8	2.5	Both	Sept 1999

Region	District	Highway	LKI Segment	Start km	End km	Length (km)	Side of Highway	Installation Date
3	9	3	1325	70.5	72.5	2.00	Both	9/1/95
3	9	3	1325	121.16	123.15	1.99	Both	3/31/95
3	9	3	1325	134.59	143.96	9.37	Both	3/31/95
3	9	22	1340	10.35	11.76	1.41	Both	3/31/95
3	9	33	1327	5	9	4.00	Both	9/1/95

Region	District	Highway	LKI Segment	Start km	End km	Length (km)	Side of Highway	Installation Date
3	10	3	1375	14.32	14.92	0.60	Southbound	3/31/95
3	10	3	1375	24.26	31.71	7.45	Southbound	3/31/95
3	10	3A	1373	59.74	60.13	0.39	Southbound	3/31/95
3	10	6	1940	102.5	105.5	3.00	Both	8/1/95
3	10	6	1950	9.98	10.35	0.37	Southbound	3/31/95
3	10	23	1952	35	38	3.00	Both	9/1/95

Region	District	Highway	LKI Segment	Start km	End km	Length (km)	Side of Highway	Installation Date
3	11	3	1380	7.24	7.94	0.70	Both	1993
3	11	3	1380	7.95	9.03	1.08	Northbound	1993
3	11	3	1380	23.54	24.73	1.19	Both	1993
3	11	3	1380	38.32	42.62	4.30	Both	1995
3	11	3	1380	58.74	62.25	3.51	Both	1993
3	11	3	1385	2.78	6.41	3.63	Northbound	1989
3	11	3	1385	18.75	21.41	2.66	Northbound	1989
3	11	3	1385	49.73	52.73	3.00	Both	1993/95
3	11	3	1395	1.47	2.24	0.77	Both	1993
3	11	3	1395	2.54	3.21	0.67	Both	1993
3	11	3	1395	2.98	4.11	1.13	Both	1993
3	11	3	1395	57.26	58.34	1.08	Both	1987
3	11	3	1395	65.03	66.04	1.01	Both	1994
3	11	93	2110	2.17	2.83	0.66	Both	3/31/95
3	11	93	2110	5.02	6.16	1.14	Both	3/31/95
3	11	93	2110	17.14	17.64	0.50	Both	3/31/95
3	11	93/95	2135	26.56	29.55	2.99	Both	1993
3	11	93/95	2140	0.21	0.87	0.66	Both	1983
3	11	93/95	2140	6.27	7.44	1.17	Both	1994
3	11	93/95	2140	51.02	52.28	1.26	Both	1992
3	11	93/95	2140	52.3	53.01	0.71	Both	1992
3	11	93/95	2140	57.74	58.31	0.57	Both	1993
3	11	93/95	2140	63.01	63.82	0.81	Westbound	1994
3	11	93/95	2140	95.41	97.05	1.64	Westbound	1994
3	11	93/95	2140	97.07	97.39	0.32	Both	1994
3	11	93/95	2140	99.15	99.7	0.55	Both	1994

Region	District	Highway	LKI Segment	Start km	End km	Length (km)	Side of Highway	Installation Date
3	11	95	2160	2.95	3.32	0.37	Westbound	1992
3	11	95	2160	12.16	13.62	1.46	Both	1993
3	11	95	2160	13.65	14.1	0.45	Both	1993
3	11	95	2160	14.19	14.82	0.63	Westbound	1994
3	11	95A	2115	12.42	12.83	0.41	Both	1983/95
3	11	95A	2115	13.17	19.79	6.62	Both	1994
3	11	95A	2115	15.72	19.24	3.52	Eastbound	1993
3	11	95A	2115	21.9	24.19	2.29	Both	1992
3	11	95A	2115	24.21	24.35	0.14	Eastbound	1992

Region	District	Highway	LKI Segment	Start km	End km	Length (km)	Side of Highway	Installation Date
4	18	97	1150	18.8	21.6	2.80	Both	11/29/99

Region	District	Highway	LKI Segment	Start km	End km	Length (km)	Side of Highway	Installation Date
4	20	16	1580	103.8	104.8	1.00	Both	10/1/94
4	20	16	1590	28.39	28.99	1.60	Both	12/1/96
4	20	16	1590	29.49	31.43	1.94	Both	12/1/96
4	20	16	1590	65.28	65.98	0.70	Both	7/16/99
4	20	16	1590	66.12	66.98	0.86	Both	7/16/99

Region	District	Highway	LKI Segment	Start km	End km	Length (km)	Side of Highway	Installation Date
4	21	49	1197	3.22	4.12	0.90	Both	9/1/96
4	21	97	1160	128.320	128.750	0.43	Both	8/30/99
4	21	97	1170	32.39	33.6	1.21	Both	9/1/96

Region	District	Highway	LKI Segment	Start km	End km	Length (km)	Side of Highway	Installation Date
5	24	16	1520	103.8	104.8	1.00	Both	12/20/95
5	24	16	1520	108.18	110.5	2.32	Both	11/29/92

Region	District	Highway	LKI Segment	Start km	End km	Length (km)	Side of Highway	Installation Date
5	25	16	1520	59.340	62.810	3.470	Both	8/1/98
5	25	16	1520	74.500	76.655	2.155	Both	8/1/95
5	25	16	1520	77.410	77.845	0.435	Both	8/1/94
5	25	16	1520	78.520	79.565	1.045	Right	8/1/95
5	25	16	1520	78.535	78.695	0.160	Left	8/1/95

Region	District	Highway	LKI Segment	Start km	End km	Length (km)	Side of Highway	Installation Date
5	25	16	1520	80.018	81.029	1.011	Both	8/1/95
5	25	16	1520	84.225	85.253	1.028	Both	8/1/95
5	25	16	1520	87.584	92.392	4.808	Left	8/1/95
5	25	16	1520	88.507	92.404	3.897	Right	10/1/96
5	25	16	1520	93.277	94.020	0.743	Both	10/1/96
5	25	16	1520	97.360	97.928	0.568	Both	8/1/95
5	25	16	1520	98.010	98.165	0.155	Right	9/1/96
5	25	16	1520	99.218	100.095	0.877	Both	9/1/96

Region	District	Highway	LKI Segment	Start km	End km	Length (km)	Side of Highway	Installation Date
5	26	37	1514	44.9	47.1	2.20	Both	1997

Region	District	Highway	LKI Segment	Start km	End km	Length (km)	Side of Highway	Installation Date
6	2	19	2313	8.367	10.555	2.188	Right	1997
6	2	19	2314	5.237	7.443	2.206	Right	1997
6	2	19	2314	8.128	10.283	2.155	Right	1997
6	2	19	2314	11.234	13.419	2.185	Right	1997
6	2	19	2347	15.851	21.100	5.249	Right	09/24/99
6	2	19	2348	9.480	14.729	5.249	Right	09/24/99

Table 12. Hourly Distribution of Animal Collisions in Southern Interior of B.C.

Time	Animal Collisions (%)	Time	Animal Collisions (%)
12:00 a.m.	2	12:00 p.m.	2
1:00 a.m.	6	1:00 p.m.	2
2:00 a.m.	2	2:00 p.m.	4
3:00 a.m.	2	3:00 p.m.	2
4:00 a.m.	4	4:00 p.m.	0
5:00 a.m.	2	5:00 p.m.	1
6:00 a.m.	3	6:00 p.m.	3
7:00 a.m.	7	7:00 p.m.	7
8:00 a.m.	2	8:00 p.m.	8
9:00 a.m.	3	9:00 p.m.	12
10:00 a.m.	6	10:00 p.m.	9
11:00 a.m.	2	11:00 p.m.	9

COST OF WILDLIFE-RELATED MOTOR VEHICLE ACCIDENTS

Wildlife-related Motor Vehicle Accidents

The cost of wildlife-related motor vehicle accidents to the residents of British Columbia is substantial. The financial impact on the province can be broken down into the following:

- Reported Accidents
- Unreported Accidents
- Accident Clean-up
- Lost Provincial Hunting License Revenues
- Lost Value of Wildlife

Reported Accidents

In addition to killing wildlife, wildlife-related motor vehicle accidents represent a serious threat to the motoring public. These accidents can result in human fatalities, injuries, and damage to motor vehicles (Table 13). Any accident may also result in multiple human fatalities.

Table 13. Wildlife-Related Fatal, Injury and Property Damage Only Accidents (1987 to 1995)

Year	Fatal Accidents	Total Number of Deaths	Injury Accidents	Property Damage Only Accidents
1987	1	1	198	2,226
1988	0	0	256	2,596
1989	1	3	199	2,590
1990	1	1	237	2,821
1991*	1	2	241	1,925
1992	2	6	238	1,975
1993	0	0	248	1,954
1994	3	9	256	2,072
1995	3	5	221	1,678

Note: In 1991, the minimum reportable aggregate property damage accident value increased from $400 to $1000.

Source: Highway Accident System, Highway Safety Section, Engineering Branch, MoTH

In British Columbia, the majority of motor vehicles are insured by the Insurance Corporation of British Columbia (ICBC). On average, ICBC processes approximately 6600 wildlife-

related accident claims a year[3]. The average cost of these claims was about $2300. Between 1997 and 1999, ICBC paid out over $48 million in wildlife-related motor vehicle accident claims (Table 14).

Table 14. ICBC Wildlife-related Motor Vehicle Accident Claims (1997 to 1999)

	1997	1998	1999	Total
Claims	$15.1 million	$15.8 million	$17.7 million	$48.6 million

Source: Insurance Corporation of British Columbia, 2000

ICBC estimates that its accident claims capture 75% of the number of wildlife-related accidents that occur in B.C. Few people in B.C. do not carry comprehensive insurance. With ICBC insurance policies, there is no penalty for a comprehensive claim so such claims do not affect policy premiums. Of the 25% of the number of B.C. wildlife-related motor vehicle accidents that ICBC estimates go unreported to it, ICBC estimates that 10% involve out-of-province vehicles, 10% involve vehicles which less that $100 in damage, and 5% of the accidents are reported to other insurance companies in B.C.

The societal costs of motor vehicle-related accidents have also been estimated by the British Columbia Transportation Financing Authority and the impact to the Province is considerable (Table 15)[4].

Table 15. Societal Costs of Motor Vehicle Accidents (BCTFA)

Accident Severity Class	Societal Cost
Fatality	$4.17 million
Injury	$97,000
Property Damage	$6,000

Source: Highway Safety Improvement Program Manual, MoTH

Unreported Accidents

Except for fatal accidents, not all wildlife-related motor vehicle accidents which occur in British Columbia are reported in the province. Some accidents involve tourists or visitors from outside B.C. In such cases, many wildlife-related accidents are reported in other jurisdictions. Other accidents involve minor damage that vehicle owners either ignore or pay for the repairs privately.

[3] Gilfillan, G., 1999, Personal Communication, Project Manager, Winter Road Research & Development, Kamloops, B.C.

[4] Perkins, M., 1999, Highway Safety Improvement Programs Manual, B.C. Ministry of Transportation and Highways

If one assumes the 6600 accidents reported to ICBC represent 75% of the actual number of vehicle damaging, wildlife-related accidents that occurred on Provincial highways, one can estimate that an additional 1650 vehicles were damaged in wildlife-related accidents.

If one assumes that these motor vehicles accidents incurred an average of $2300 in damages, the total unreported damage incurred by motor vehicles in B.C. in 1999 totaled $3.8 million.

Accident Clean-up

Ministry Maintenance Contractors incur costs due to staff and equipment time required for the clean-up of wildlife-related accidents and the disposal of animal remains. Depending on the size of the animal involved and the location of the accident, the cost of clean-ups can vary dramatically. While smaller animals, such as porcupine and skunks, may be handled by a single person in one vehicle, larger animals, such as moose, elk, and caribou, often require two or three people with two vehicles and a hydraulic boom.

If one assumes the following staff and equipment time costs:

- $25 for small-sized animals (fox, porcupine, skunks, etc),
- $100 for medium-sized animals (bear, cougar, deer, mountain sheep, etc), and
- $350 for large-sized animals (caribou, elk, moose, etc);

Ministry Maintenance Contractors spent over $600,000 dealing with wildlife-related accident clean-up and disposal in 1999. These expenditures do not include the costs incurred by the Maintenance Contractors for insurance premiums and lost employee productivity or the Workers' Compensation Board for compensation payments when workers get injured dealing with wildlife-related accidents.

Lost Provincial Hunting License Revenues

In British Columbia, hunting license sales generate millions of dollars for the Provincial Government each year. If every wild game animal killed on Provincial highways represented an opportunity to sell a hunting license, the Provincial Government lost over $2 million in revenues in 1999. The value of hunting licenses varies greatly between species and whether or not the hunter is a B.C. resident (Table 16).

If every wild game animal reported killed on provincial highways represented an opportunity to sell a hunting license, the Province of British Columbia lost between $80,000 and $400,000 in hunting license revenues in 1999. If a 3 to 1 factor of unreported to reported animals killed is used, the Province of British Columbia could have lost between $300,000 and $1.5 million in hunting license revenues in 1999.

Table 16. Provincial Hunting License Fees for Residents and Non-residents

Species	Resident fees ($)	Non-resident fees ($)
bear	20	130
caribou	20	150
cougar	30	150
deer	15	75
elk	25	150
grizzly bear	80	530
moose	25	150
mountain goat	30	200
mountain sheep	590	400

Source: B.C. Ministry of Environment, Lands and Parks (MELP)

Lost Value of Wildlife

The Wildlife Branch of the B.C. Ministry of Environment, Lands and Parks (MELP) has done extensive analysis of the economic value of wildlife resources in the province[5]. In B.C., participants in hunting and viewing make estimated current expenditures of about $466 million each year that are directly associated with their wildlife-related recreation.

The expenditures by participants in wildlife-related activities and their impacts on income and employment are spread throughout the Province and make important contributions to many rural economies. In 1996, MELP estimated expenditures on resident hunting and wildlife activities supported about $205 million of Provincial Gross Domestic Product and $136 million of household income[6].

Lost Value of Wildlife for Resident and Non-resident Hunters

Approximately 100,000 B.C. residents purchase hunting licenses annually and spend an estimated 1.5 million days hunting in the province each year[7]. Approximately 4,500 non-residents spend about 46,000 days hunting in B.C. each year[8].

One measure of the value of wildlife lost due to motor vehicle-related accidents can be estimated by determining how much hunters are willing to pay to hunt.

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[5] Reid, R., 2000, Personal Communication, Economist, B.C. Ministry of Environment, Lands and Parks (MELP), Wildlife Program, Victoria, B.C.
[6] Ibid
[7] Ibid
[8] Ibid

MELP surveyed thousands of resident hunters in 1996 to determine their "willingness to pay" in order to obtain an animal from a certain species (Table 17). According to MELP, the "willingness to pay" by B.C. hunters to obtain a certain species of animal can be considered the equivalent of the "true net market value" of that species. For non-resident hunters, the "net return" to the Province is determined to be the value of their expenditures less the cost to the Province for supplying the services they need[9].

For every wild game animal reported killed on provincial highways in 1999, the Province of British Columbia would have earned over $6 million in the market value of the animals to resident hunters. If a 3 to 1 factor of unreported to reported animals killed is used, the Province of British Columbia would have lost over $23 million from resident hunters in 1999.

The value of non-resident hunting in B.C. is significant. Non-resident hunters contribute to the provincial economy by purchasing hunting licenses and supplies, and hiring hunting guides. If every wild game animal reported killed on provincial highways represented an opportunity for non-resident hunters to hunt in the Province, the Province of British Columbia would have lost over $30 million in net returns in 1999. If a 3 to 1 factor of unreported to reported animals killed is used, the Province of British Columbia would have lost over $113 million in net returns from non-resident hunters in 1999.

Table 17. Resident and Non-resident Hunters Net Value to B.C.

	Net Value to B.C.	
Species	**Resident Hunters ($)**	**Non-resident Hunters ($)**
bear	950	2,340
caribou	2,960	2,930
cougar	2,050	3,400
deer	1,270	7,450
elk	3,250	3,290
moose	1,250	1,680
mountain sheep	4,700	4,170

Source: B.C. Ministry of Environment, Lands and Parks (MELP), Wildlife Program

The true market value of wildlife may be more accurately determined by public auction, but only if all hunting opportunities were auctioned. As a fund raising initiative supported by the Alberta Provincial Government, the Rocky Mountain Elk Foundation auctioned one non-resident elk hunting permit ("tag") and one non-resident bighorn sheep tag in 1998 and 1999. The successful bids on the tags are shown in Table 18.

[9] Reid, R., 2000, Personal Communication, Economist, B.C. Ministry of Environment, Lands and Parks (MELP), Wildlife Program, Victoria, B.C.

Table 18. Rocky Mountain Elk Foundation Elk and Bighorn Sheep Tag Auction Results

Auction Item	1998	1999
Elk tag (non-resident)	$20,874	$26,265
Bighorn Sheep tag (non-resident)	$607,500	$495,000

Source: Nicholson, J., 2000, Personal Communication, Rocky Mountain Elk Foundation, Edmonton, Alberta

In January, 2000, MELP auctioned off a mountain sheep hunting license in Reno, Nevada for $260,000 (Canadian dollars) as a fund raising initiative for the B.C. Habitat Conservation Trust Fund to help support mountain sheep management[10]. Although the successful bids in the auctions for B.C. and Alberta wild game animals are considerably higher than the value MELP has generally determined for these types of animals, the auction results show that certain species wildlife are considered very valuable by some hunters. One should note these auction results are extreme values and they are not representative of typical hunter values.

Lost Value of Wildlife for Non-hunting Residents

No species-specific figures are available for the value of wildlife to non-hunting residents[11]. Regardless, the presence of wildlife generates considerable economic activity in B.C. MELP estimates 863,000 provincial residents spent 18 million days in direct wildlife activities with the main purpose of watching, photographing, feeding and studying wildlife in the field in 1996[12].

The impact of motor vehicle-related accidents on wildlife species with critically low populations can have serious implications on wildlife viewing activities. Species, such as mountain goats and mountain sheep, which attract viewing attention, have low reproduction rates and limited areas of habitat. Consequently, the loss of even a few members of a small herd in motor vehicle-related accidents can threaten the survival of the herd and reduce the long-term provincial economic benefits generated by residents viewing the herd.

MELP estimates B.C. residents participating in direct wildlife activities, where the main purpose of a trip was to see wildlife in the field, spent almost $392 million in 1996, contributing over $174 million to the Provincial Gross Domestic Product.

[10] Reid, R., 2000, Personal Communication, Economist, B.C. Ministry of Environment, Lands and Parks (MELP), Wildlife Program, Victoria, B.C.
[11] Ibid
[12] Ibid

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Nicholson, J., 2000, Personal Communication, Rocky Mountain Elk Foundation, Edmonton, Alberta

Reid, R., 2000, Personal Communication, Economist, B.C. Ministry of Environment, Lands and Parks (MELP), Wildlife Program, Victoria, B.C.

Zacharias, C., 1999, Personal Communication, Environmental Services Assistant, Ministry of Transportation and Highways (MoTH), Engineering Branch, Environmental Services Section, Victoria, B.C.

FEEDBACK

WARS is only made possible by the collective efforts of the Ministry's Maintenance Contractors who complete the monthly accident report forms, the District Highways Staff who assemble and proof them, and the Headquarters Staff who support the WARS database system. We would like to extend our thanks to everyone who contributes to the WARS system and helps keep the WARS as current as possible.

If you have any questions or comments regarding this publication, please let us know as we would appreciate your feedback.

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Engineering Branch
Ministry of Transportation and Highways
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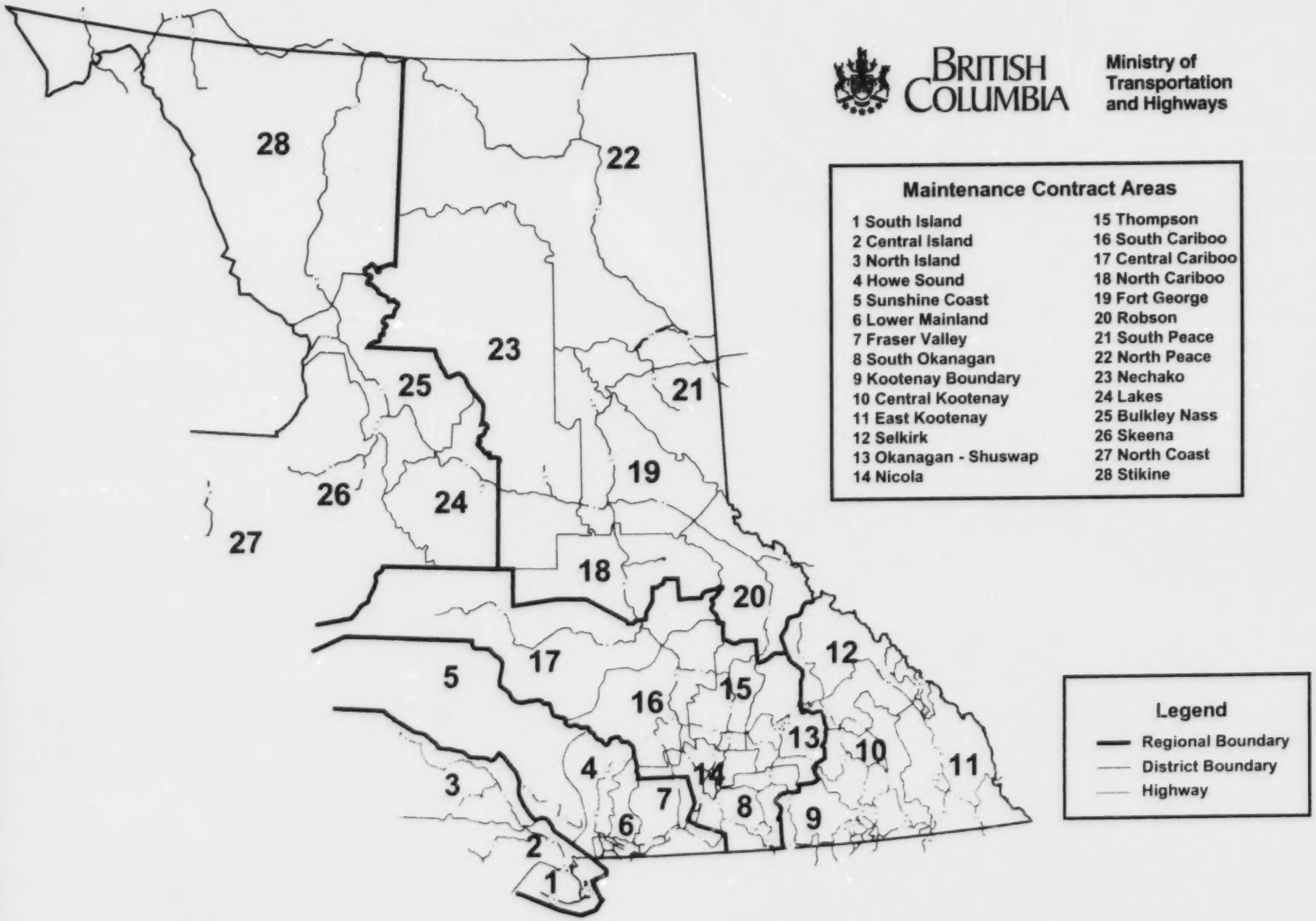
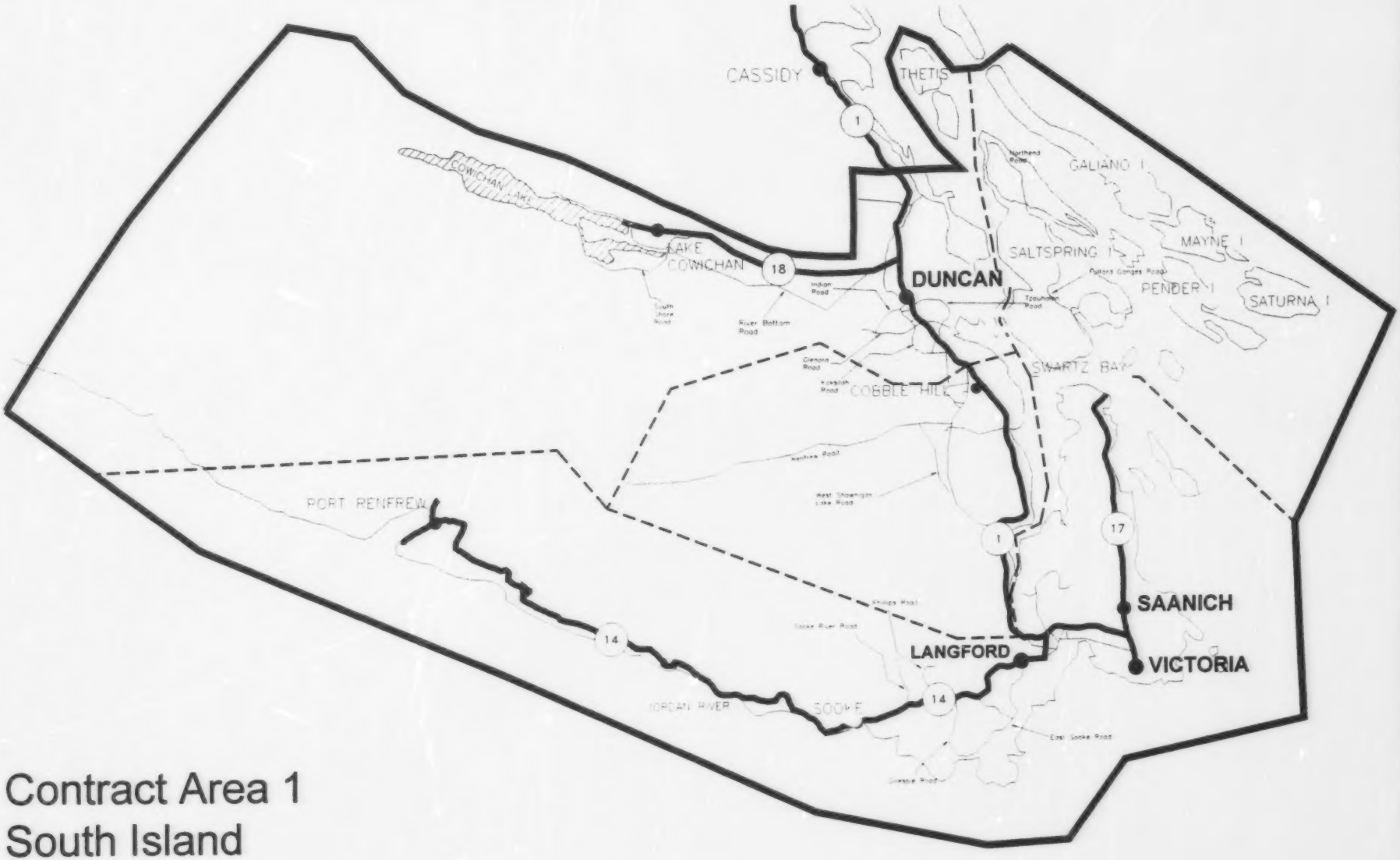
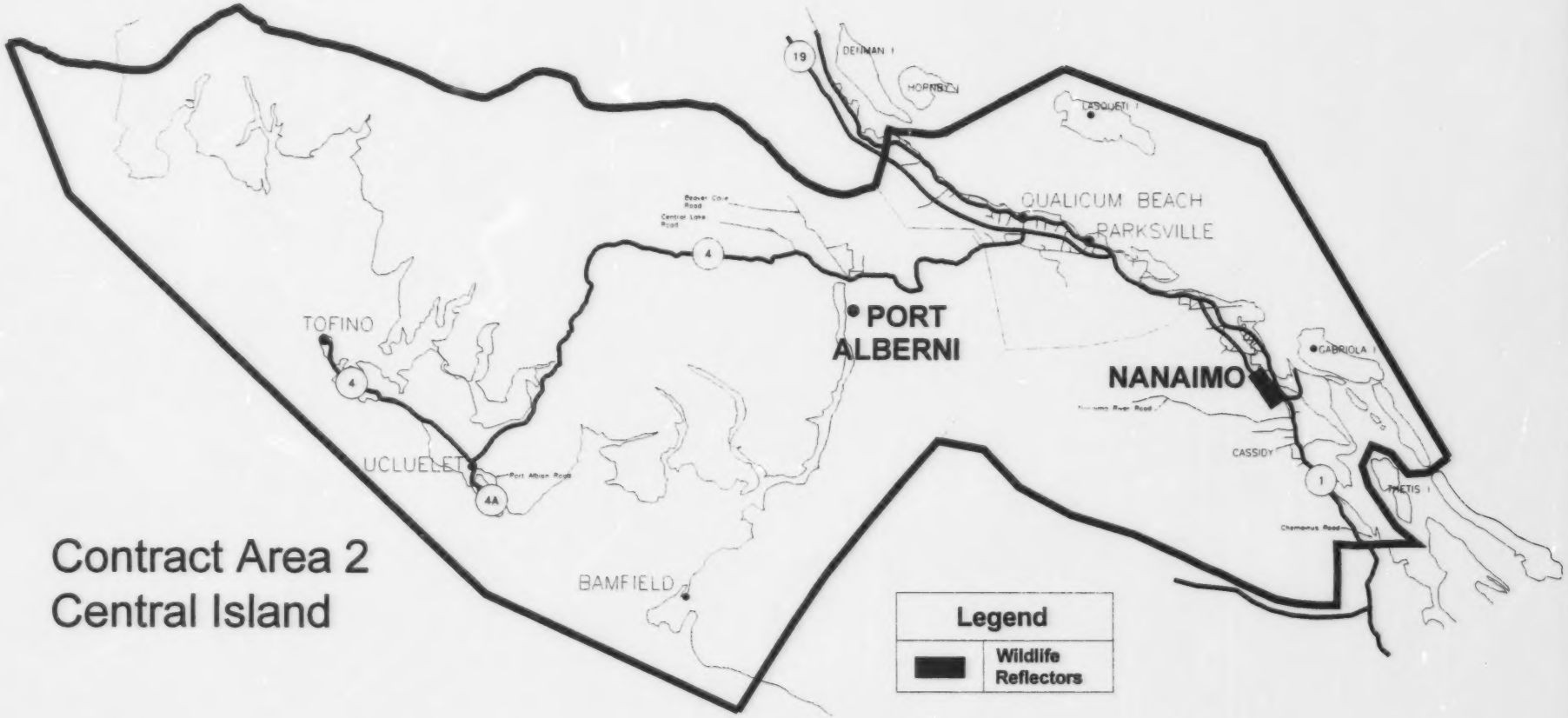
APPENDIX A

Ministry Maintenance Contract Areas


BRITISH COLUMBIA
Ministry of Transportation and Highways
Maintenance Contract Areas
1 South Island
2 Central Island
3 North Island
4 Howe Sound
5 Sunshine Coast
6 Lower Mainland
7 Fraser Valley
8 South Okanagan
9 Kootenay Boundary
10 Central Kootenay
11 East Kootenay
12 Selkirk
13 Okanagan - Shuswap
14 Nicola
15 Thompson
16 South Cariboo
17 Central Cariboo
18 North Cariboo
19 Fort George
20 Robson
21 South Peace
22 North Peace
23 Nechako
24 Lakes
25 Bulkley Nass
26 Skeena
27 North Coast
28 Stikine
Legend
Regional Boundary
District Boundary
Highway



Contract Area 1
South Island



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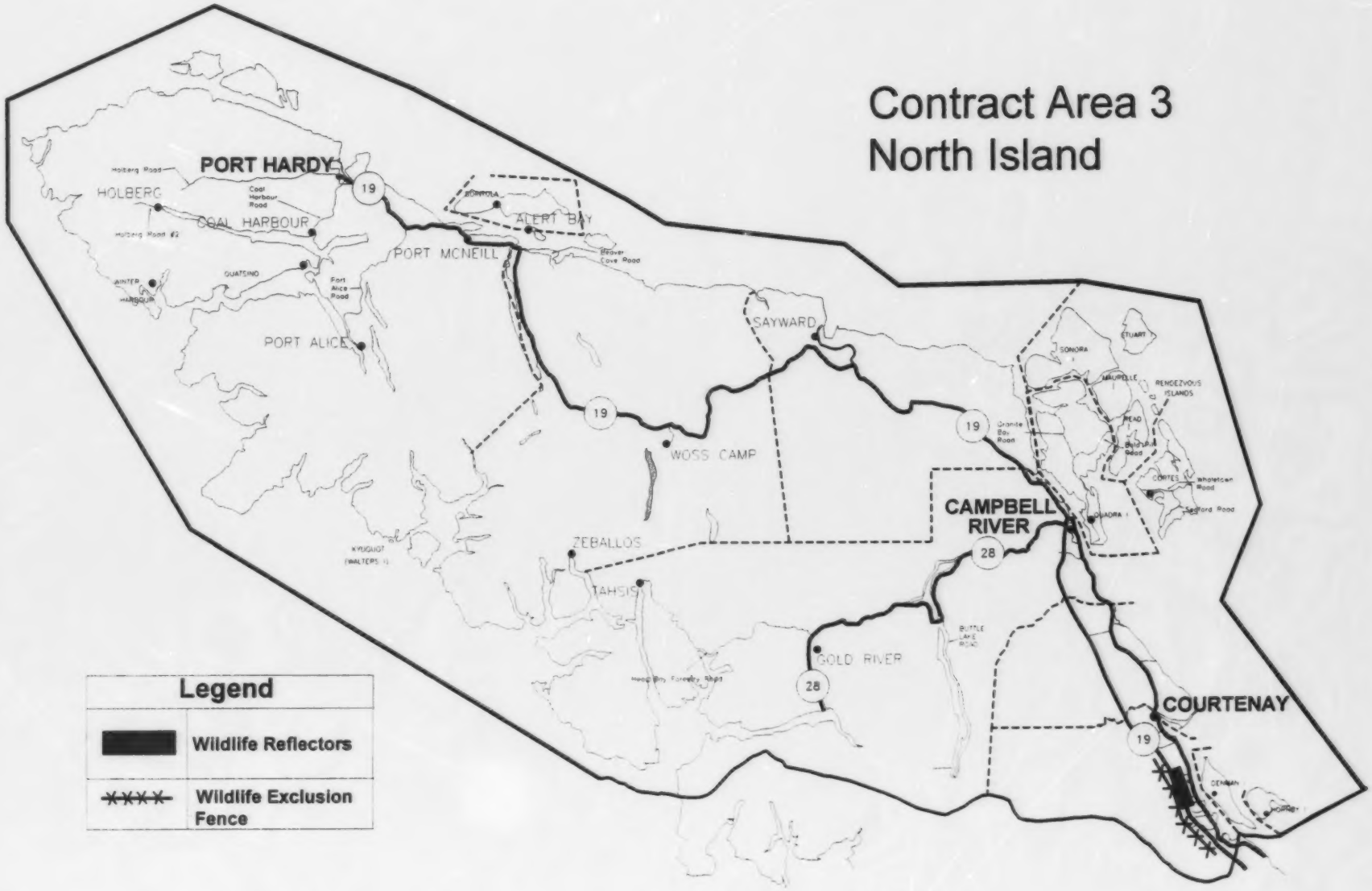
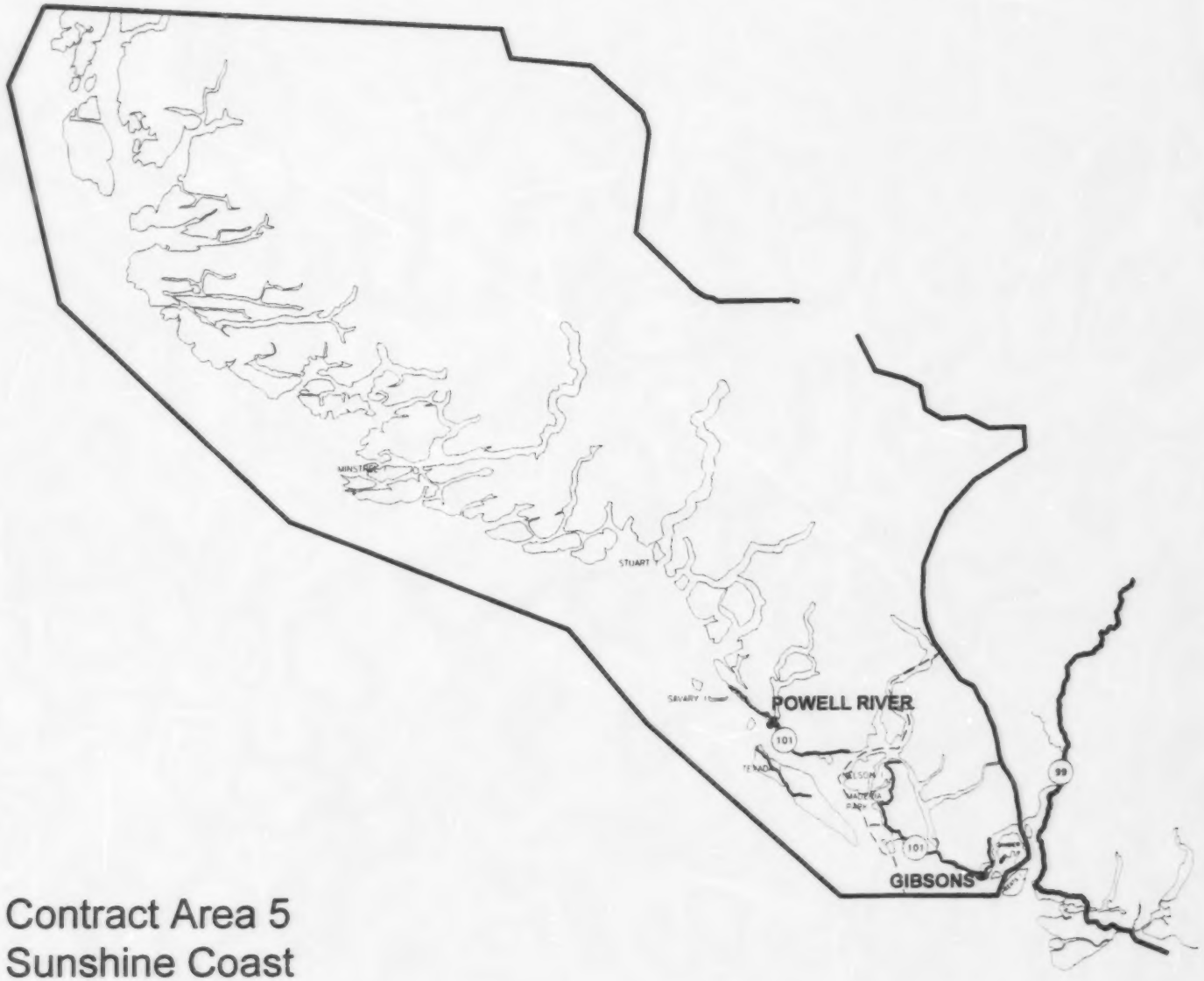
Central Island

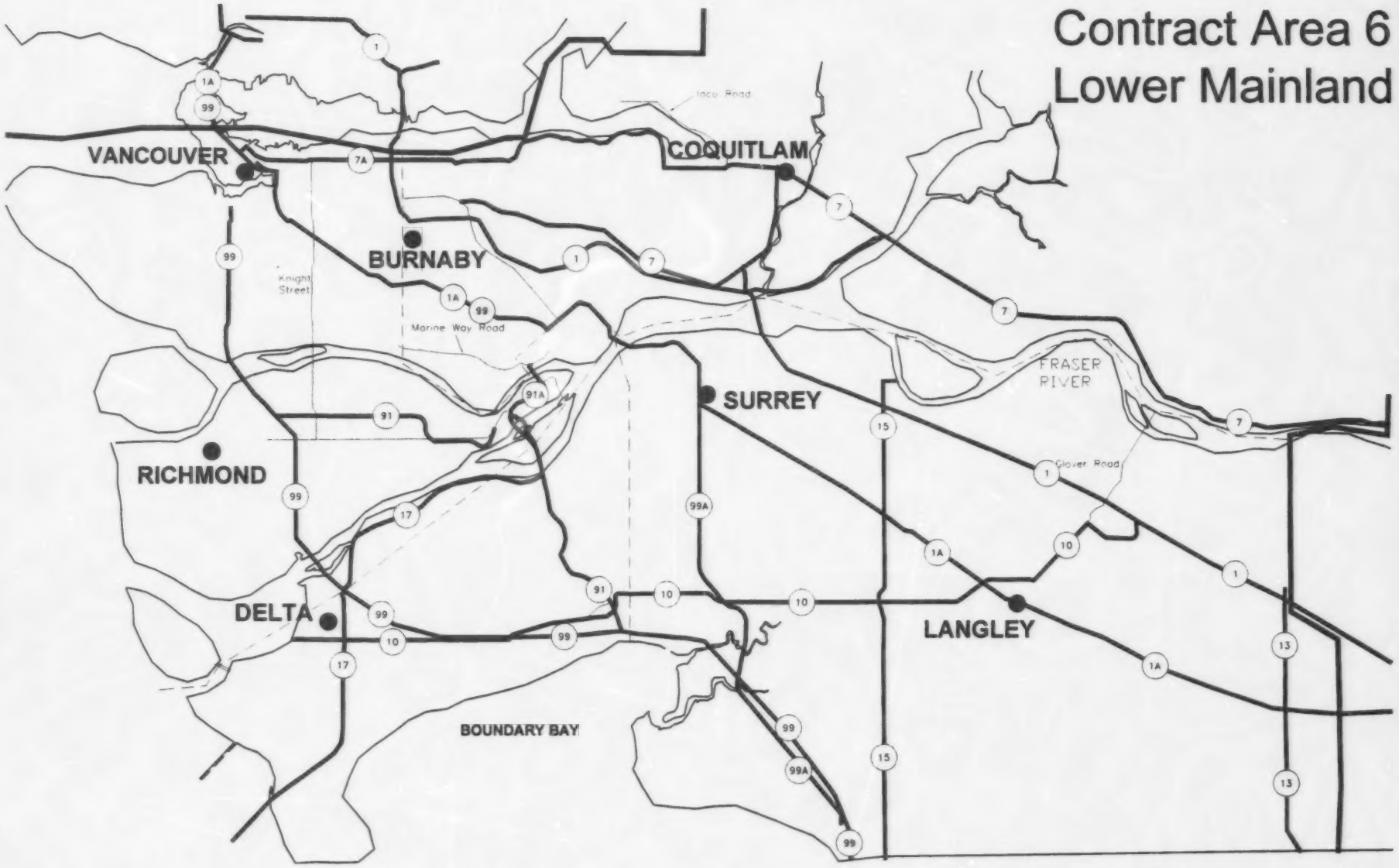

Contract Area 3
North Island
PORT HARDY
HOLBERG
COAL HARBOUR
PORT MCNEILL
ALERT BAY
PORT ALICE
SAYWARD
WOSS CAMP
CAMPBELL RIVER
ZEBALLOS
TAHSIS
GOLD RIVER
COURTENAY
19
28
Legend
Wildlife Reflectors
Wildlife Exclusion Fence

Contract Area 4
Howe Sound



Contract Area 5
Sunshine Coast

Contract Area 6
Lower Mainland



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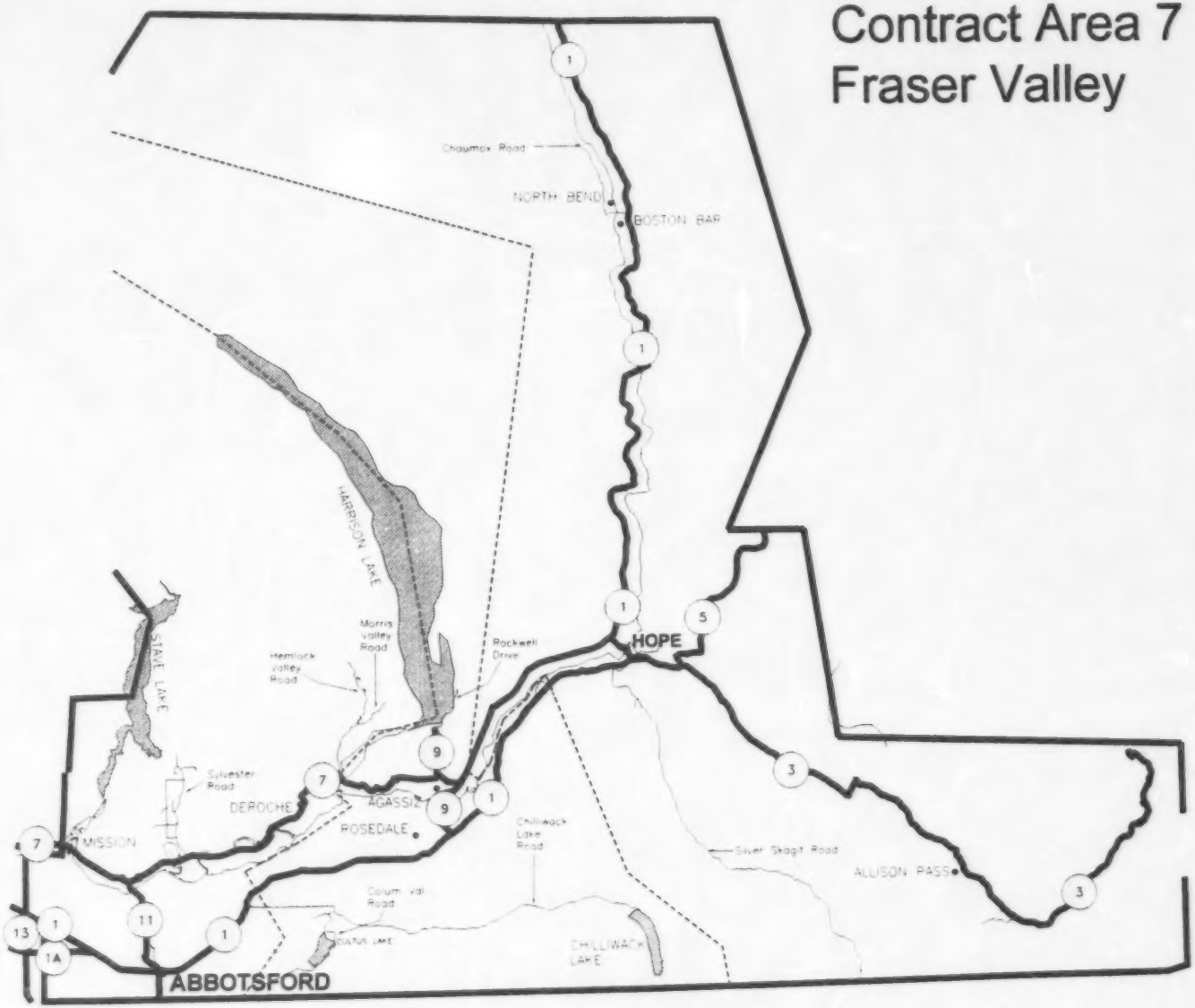
Fraser Valley



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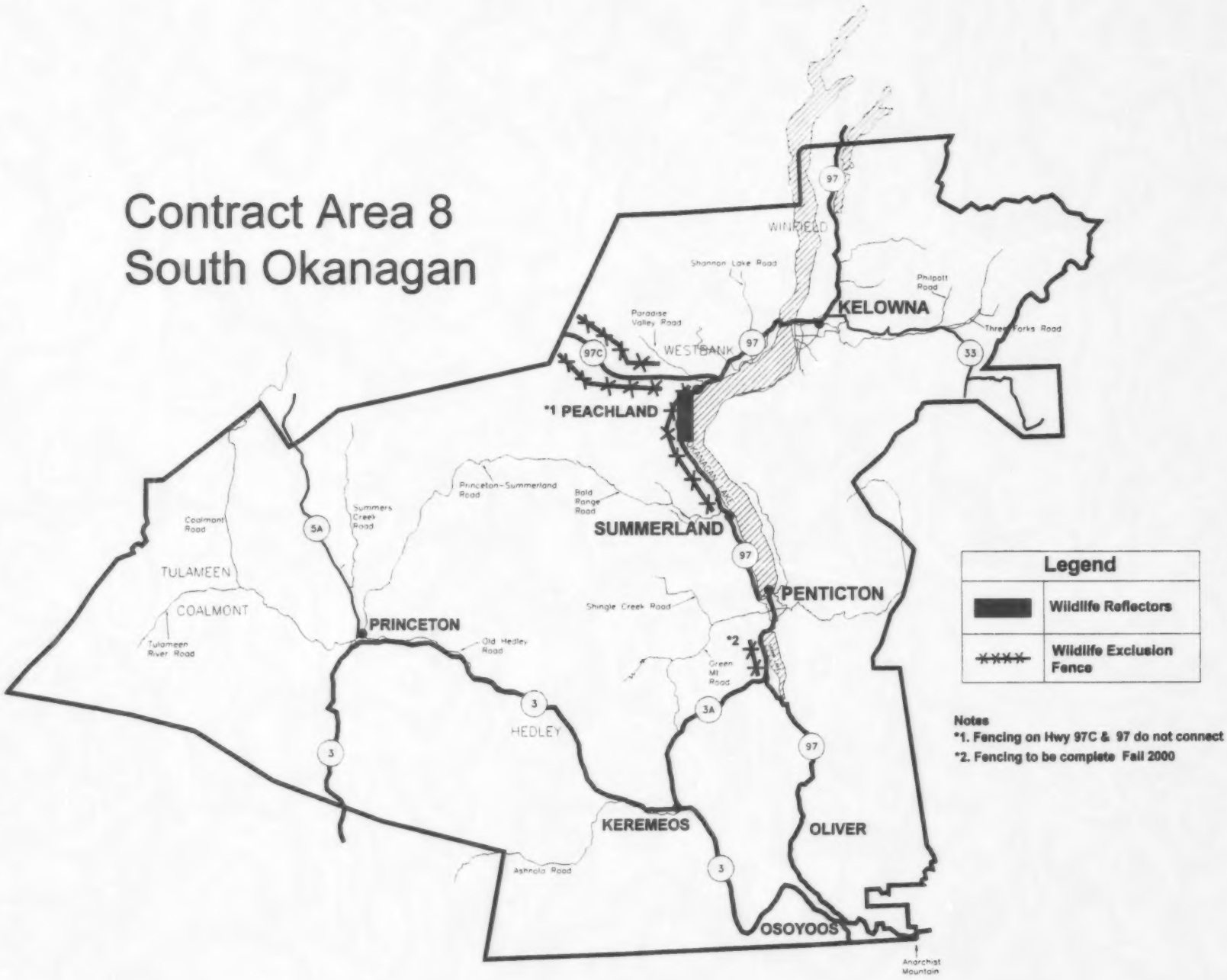
South Okanagan

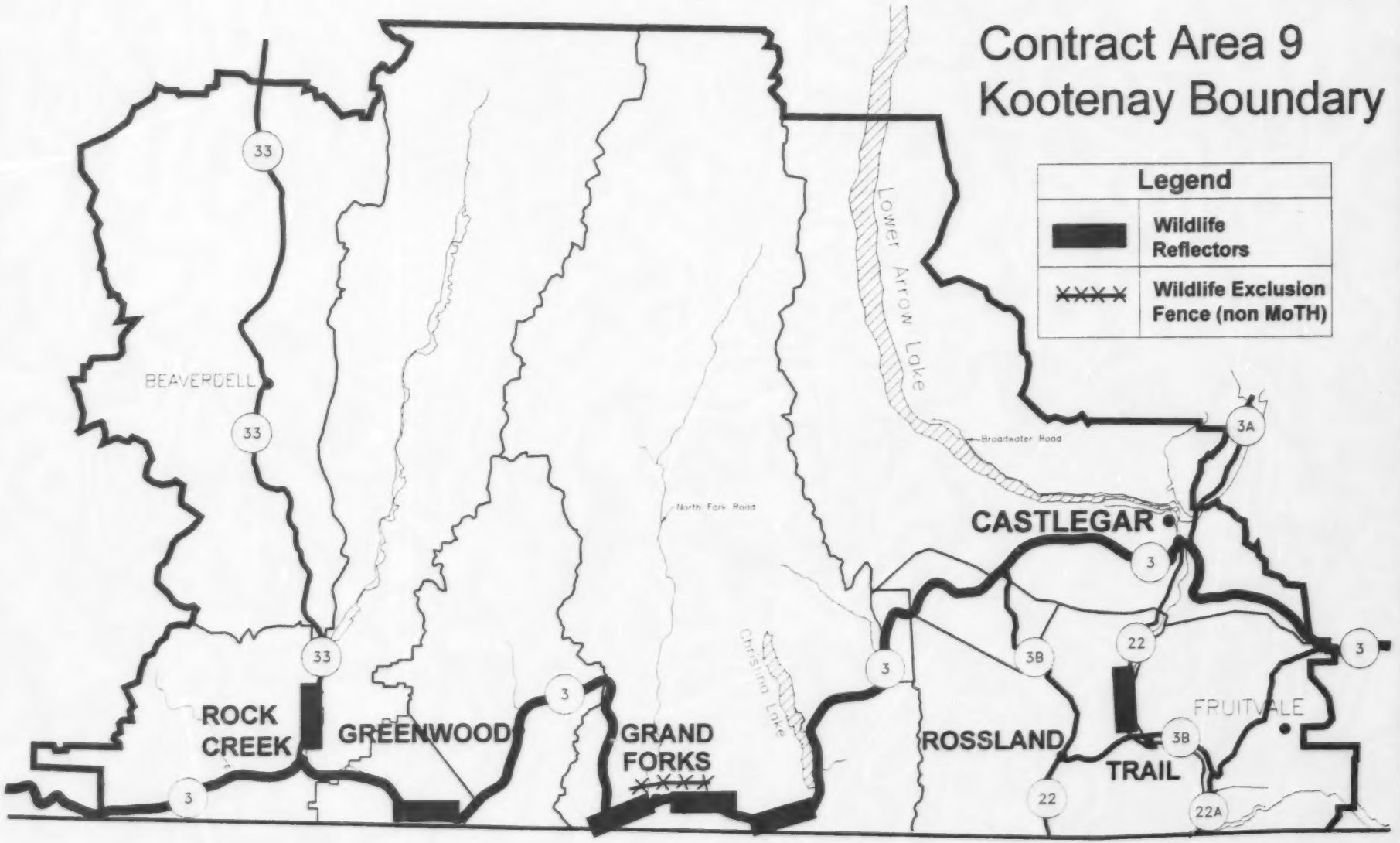


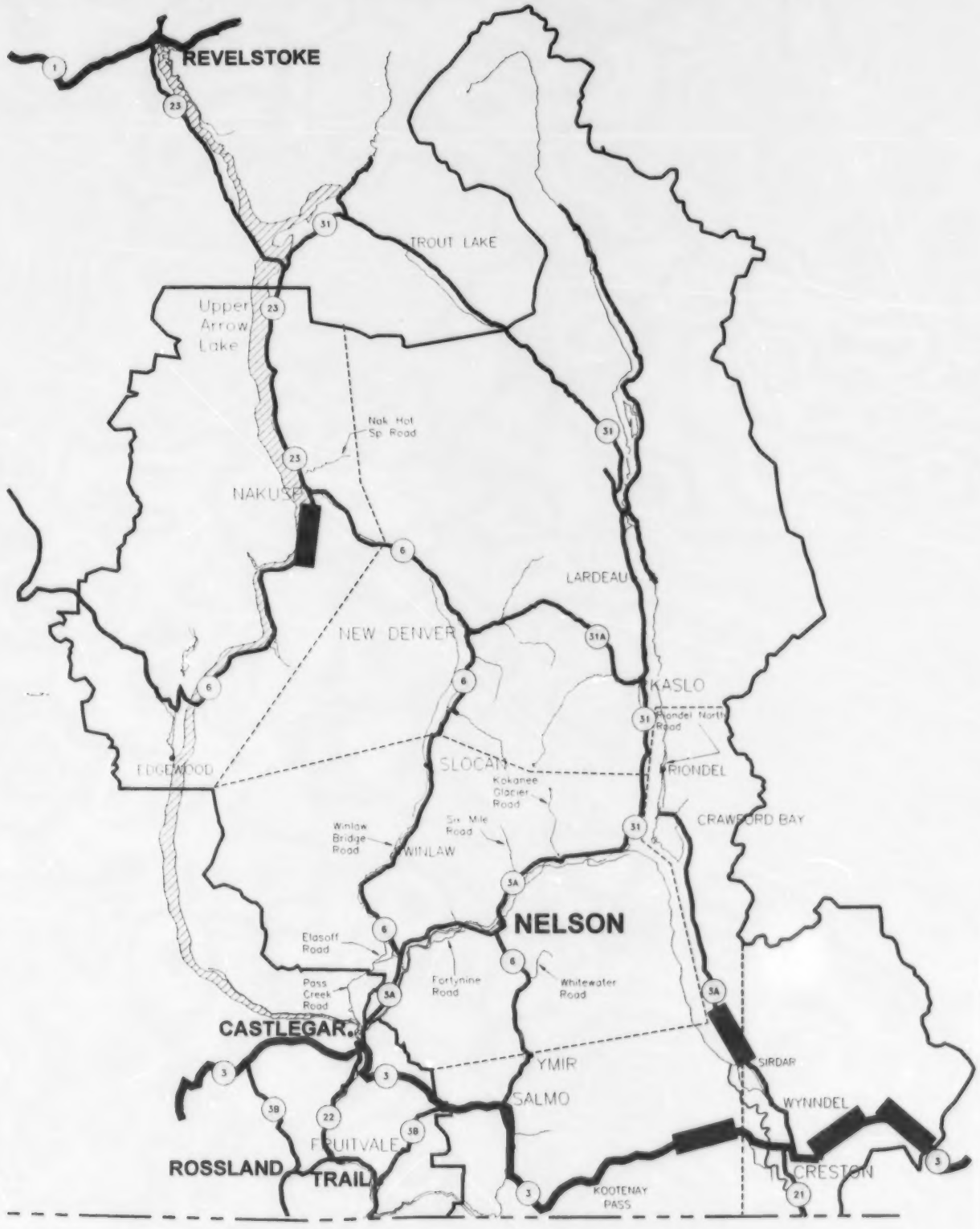
Legend	
	Wildlife Reflectors
××××	Wildlife Exclusion Fence

Notes

***1. Fencing on Hwy 97C & 97 do not connect**

***2. Fencing to be complete Fall 2000**


Contract Area 9
Kootenay Boundary
Legend
Wildlife Reflectors
Wildlife Exclusion Fence (non MoTH)
Lower Arrow Lake
Broadwater Road
North Fork Road
Christina Lake
BEAVERDELL
33
33
33
3
3
3
3A
3B
3B
22
22
22A
CASTLEGAR
ROCK CREEK
GREENWOOD
GRAND FORKS
ROSSLAND
TRAIL
FRUITVALE

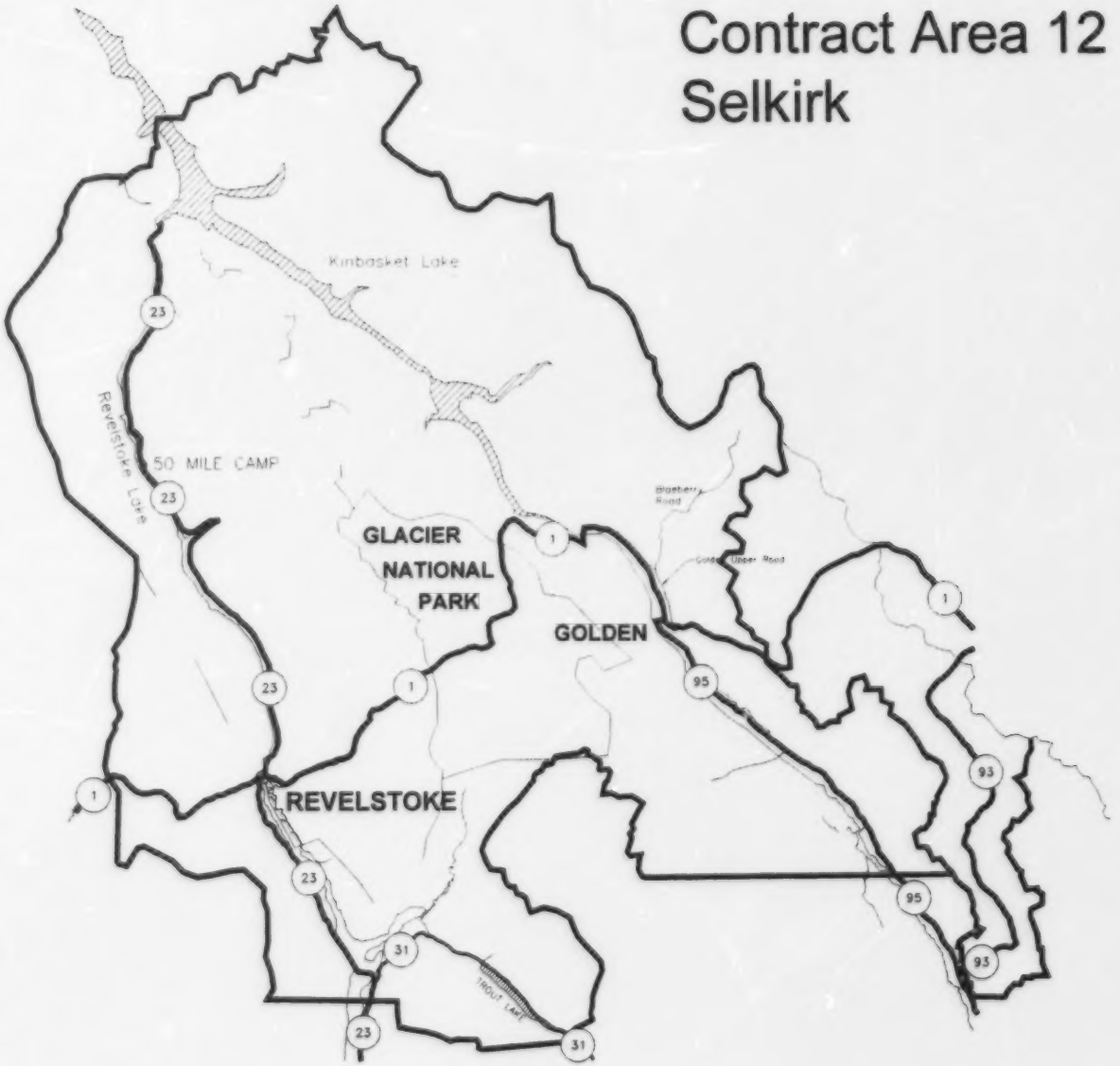


Contract Area 10
Central Kootenay

Legend	
	Wildlife Reflectors

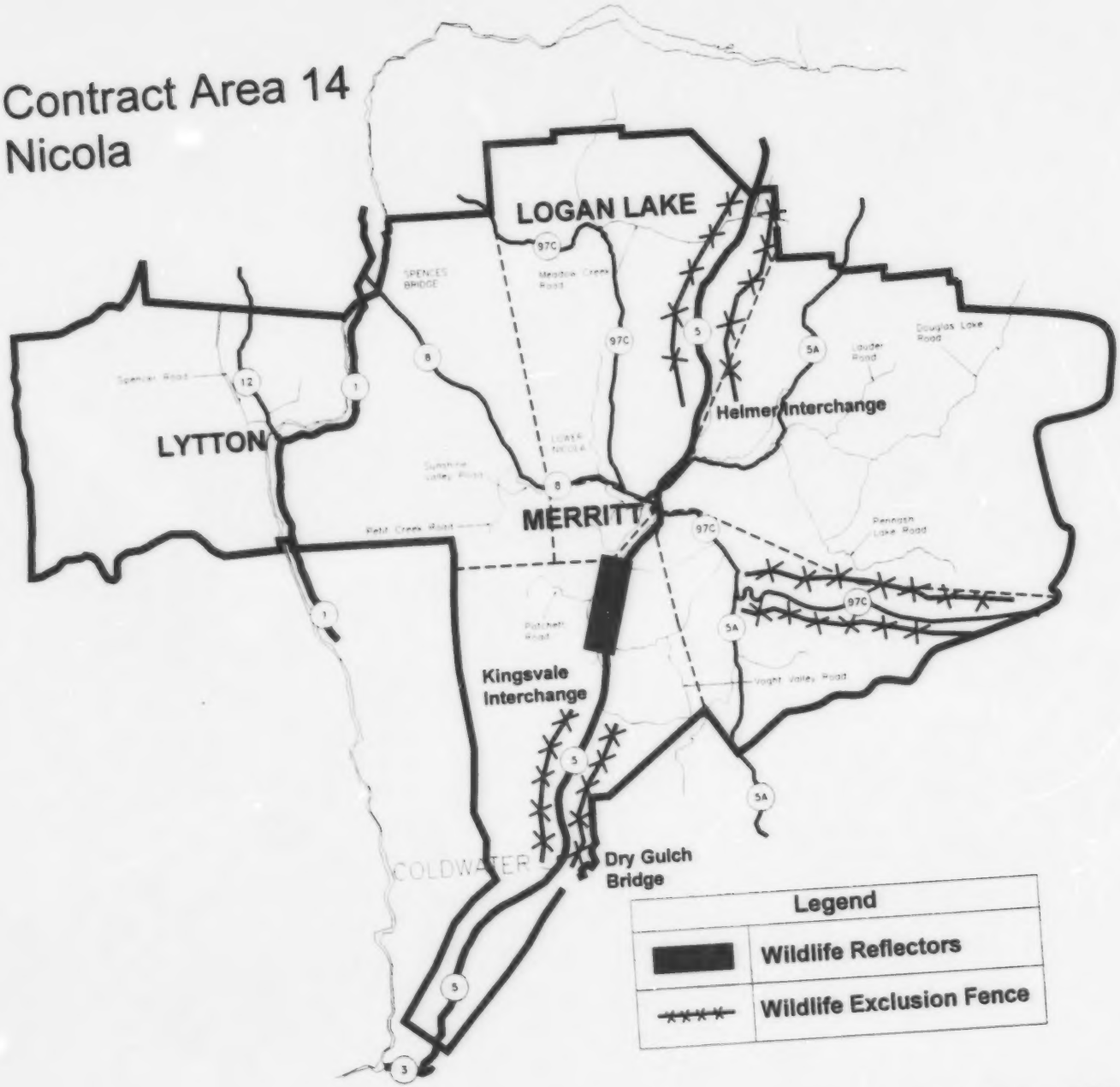
Contract Area 11
East Kootenay
RADIUM
INVERMERE
FAIRMONT
ELKFORD
WASA
SPARWOOD
KIMBERLEY
FERNIE
CRANBROOK
JAFFRAY
ELKO
KINGSGATE
Legend
Wildlife Reflectors
U. S. A.

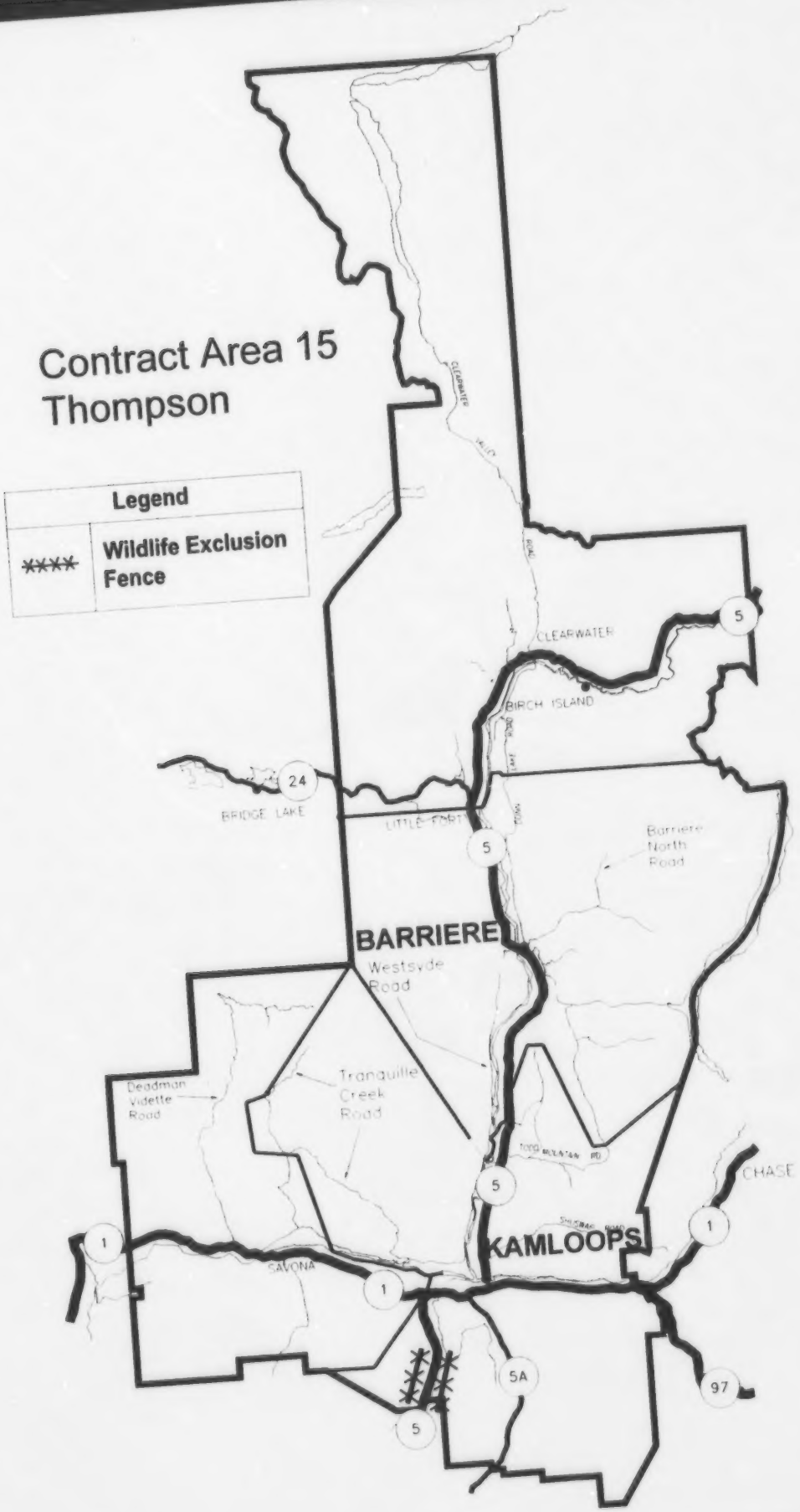
Contract Area 12
Selkirk



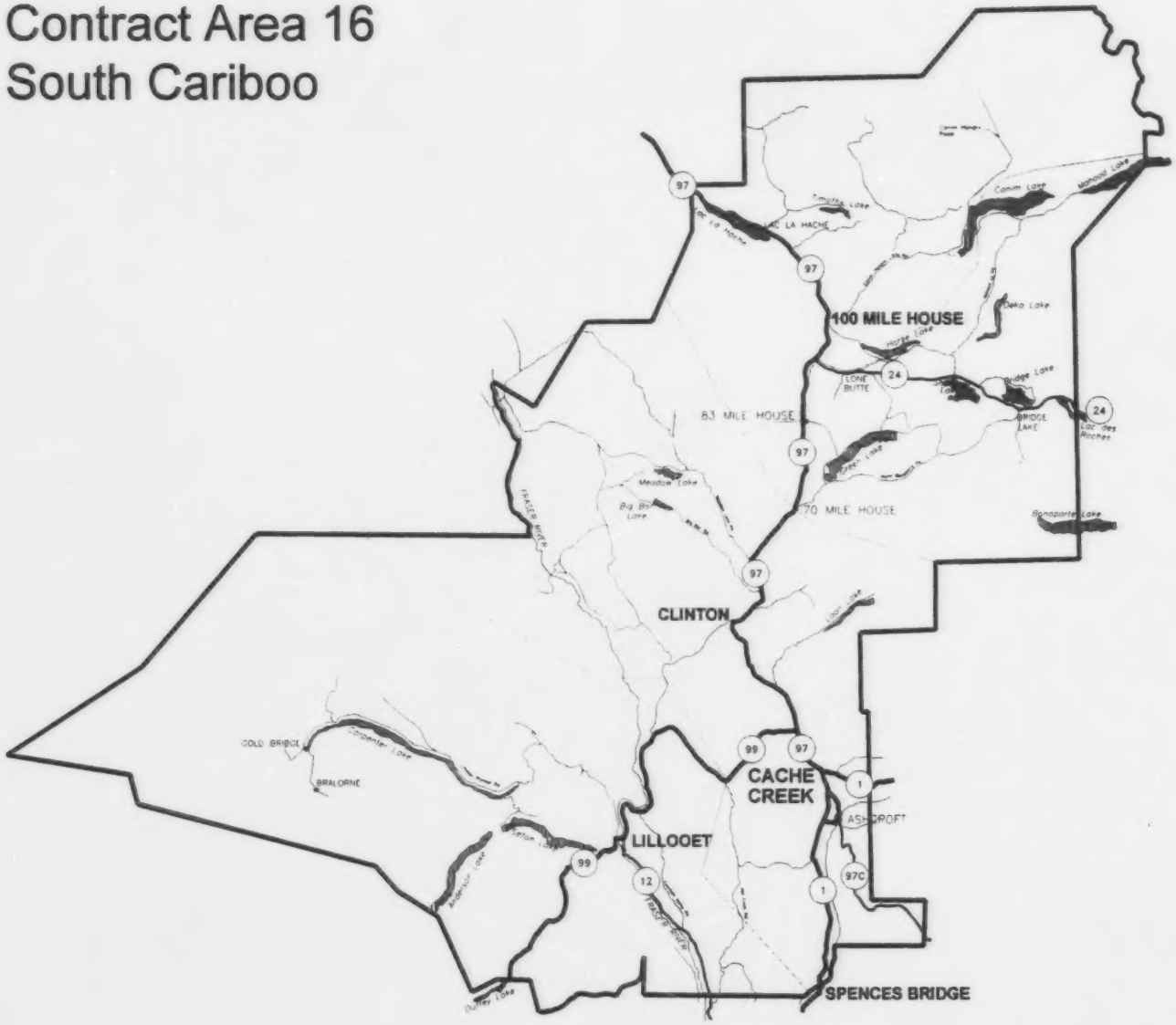
Contract Area 13
Okanagan - Shuswap

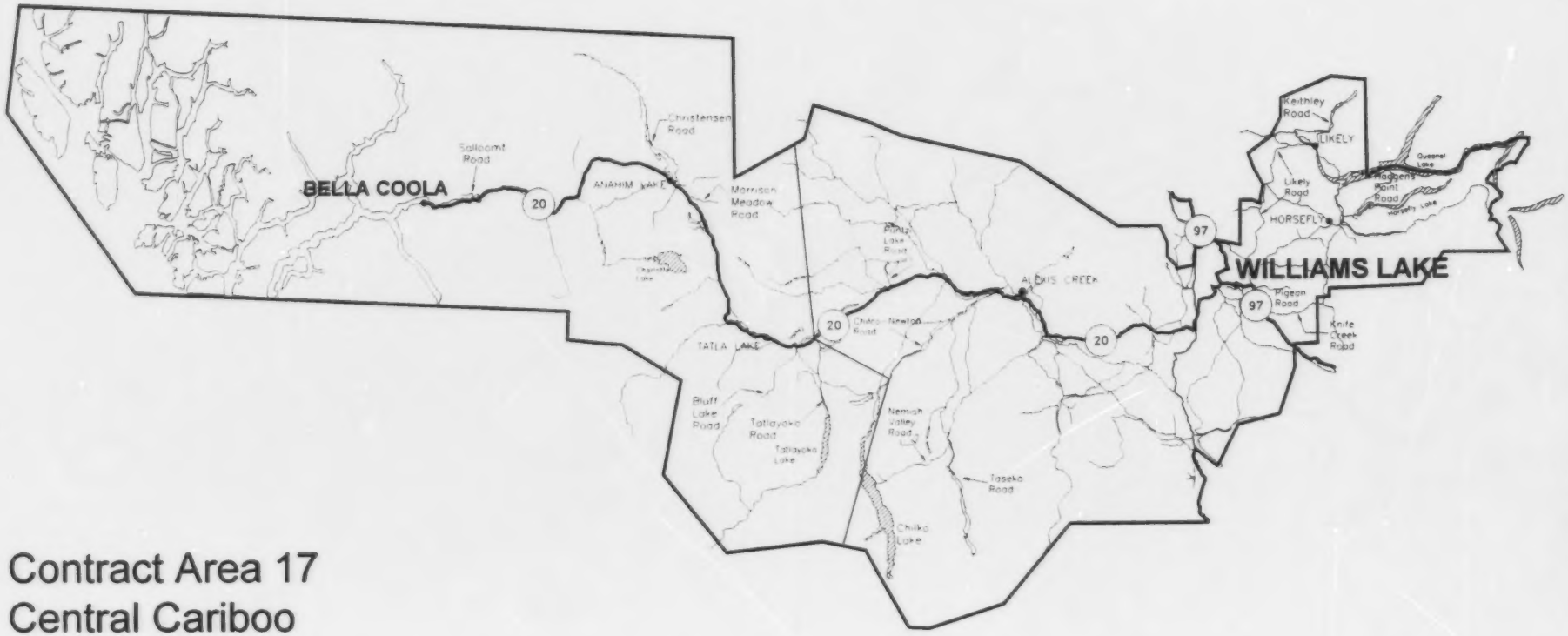
Contract Area 14
Nicola




Contract Area 15
Thompson
Legend
Wildlife Exclusion Fence
CLEARWATER
BIRCH ISLAND
BRIDGE LAKE
LITTLE FORT
Barriere North Road
BARRIERE
Westsyde Road
Tranquille Creek Road
Deadman Vidette Road
CHASE
KAMLOOPS
CAVONA
5
24
1
5A
97

Contract Area 16
South Cariboo





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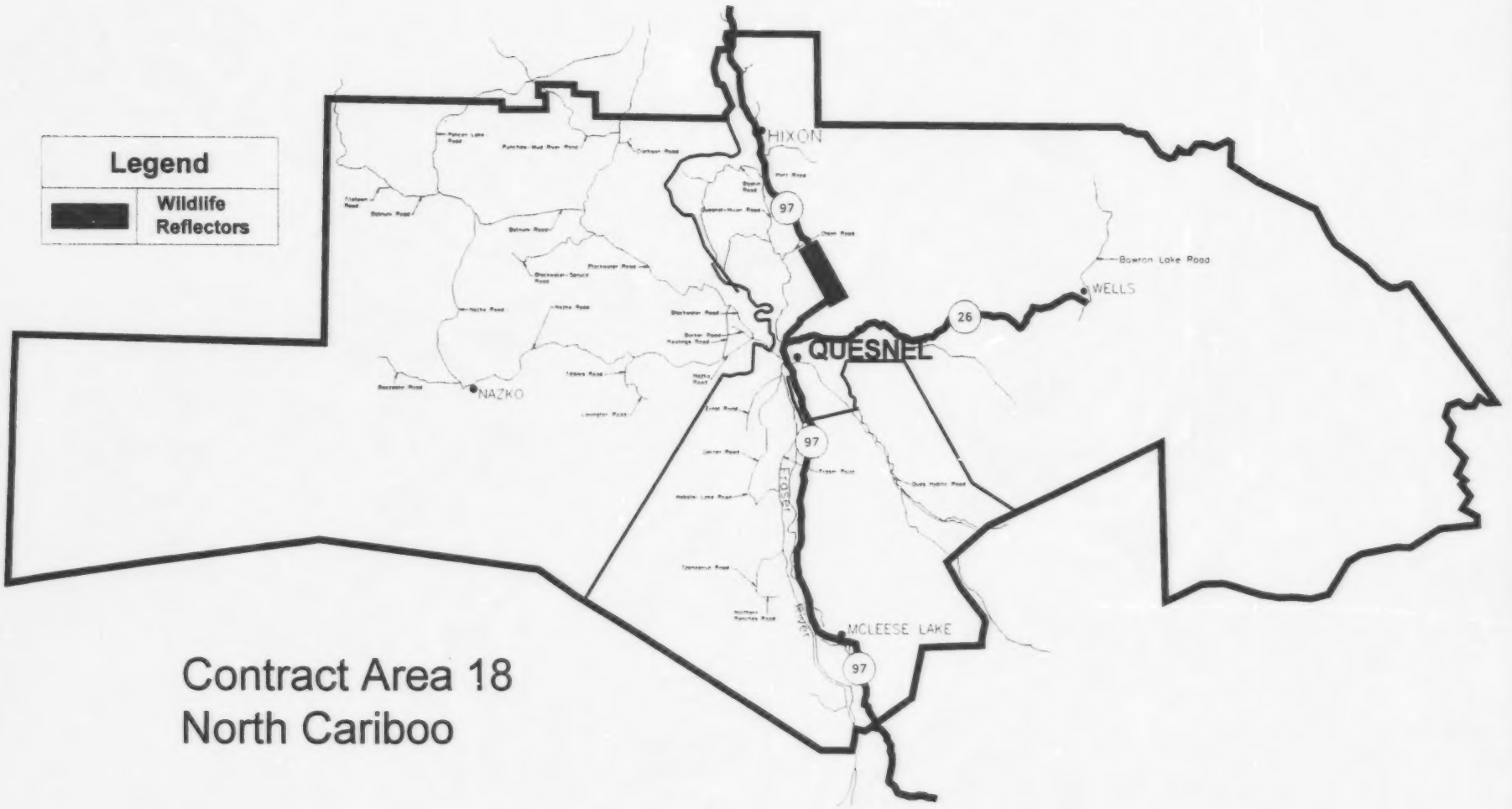
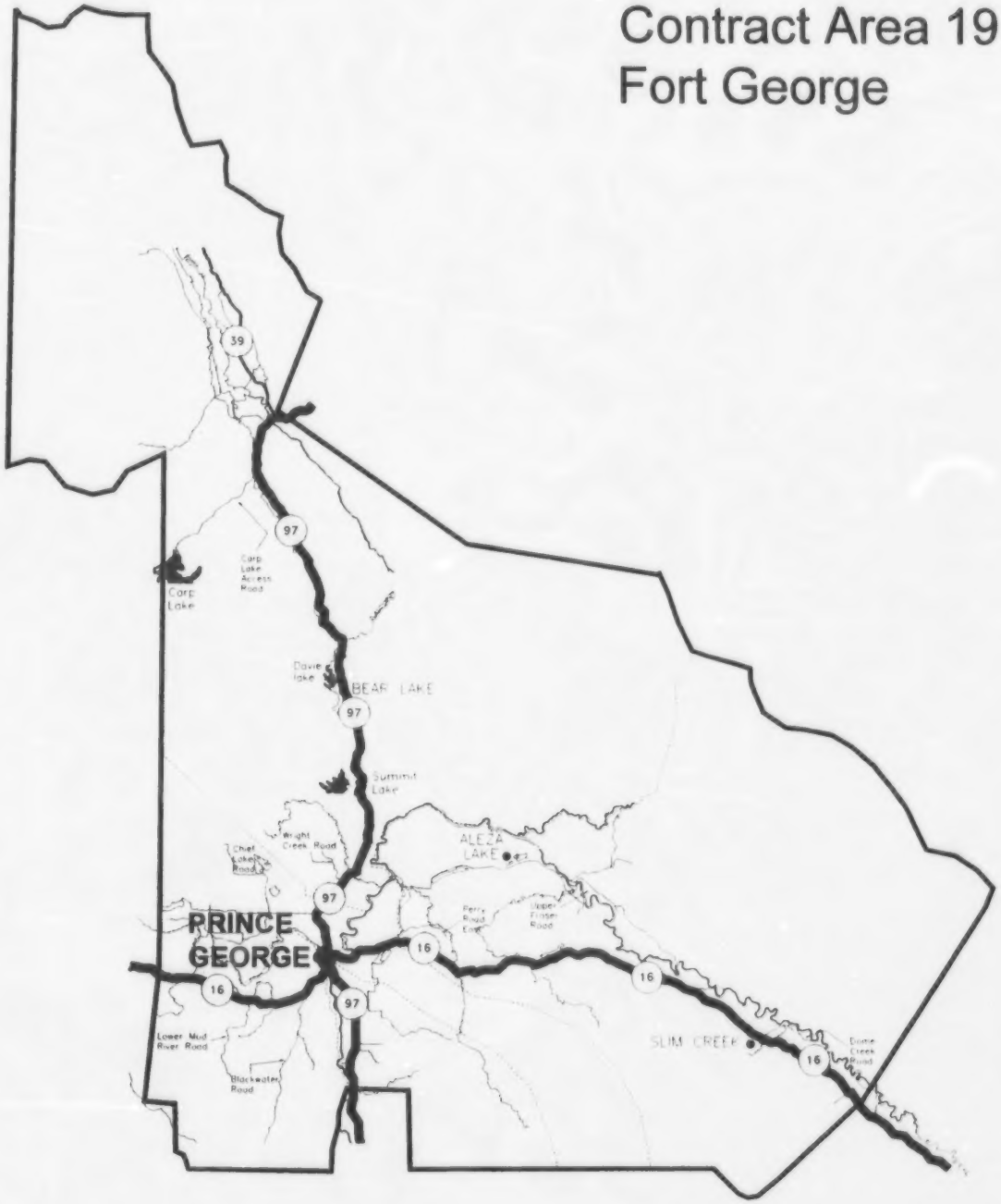
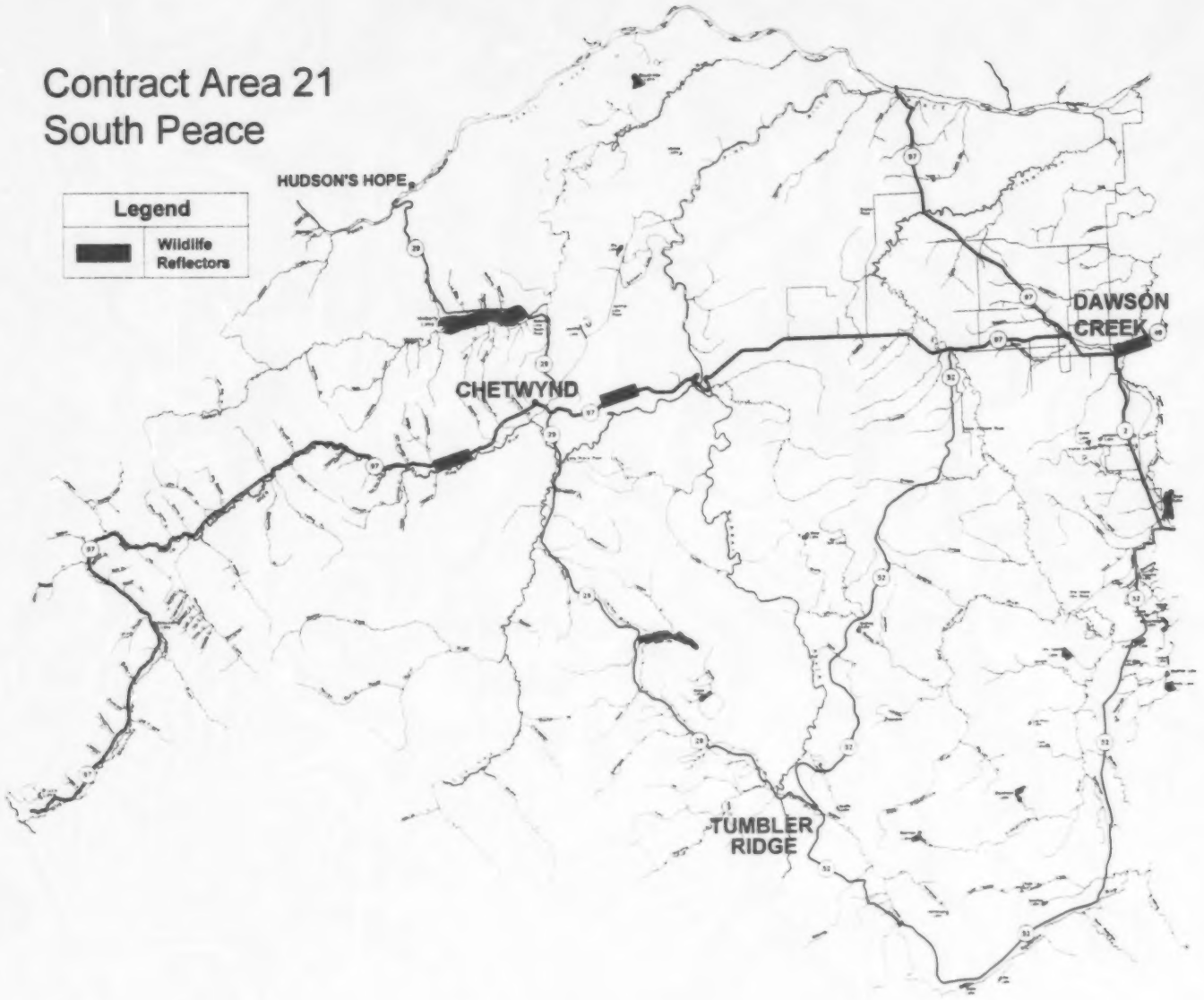
Central Cariboo

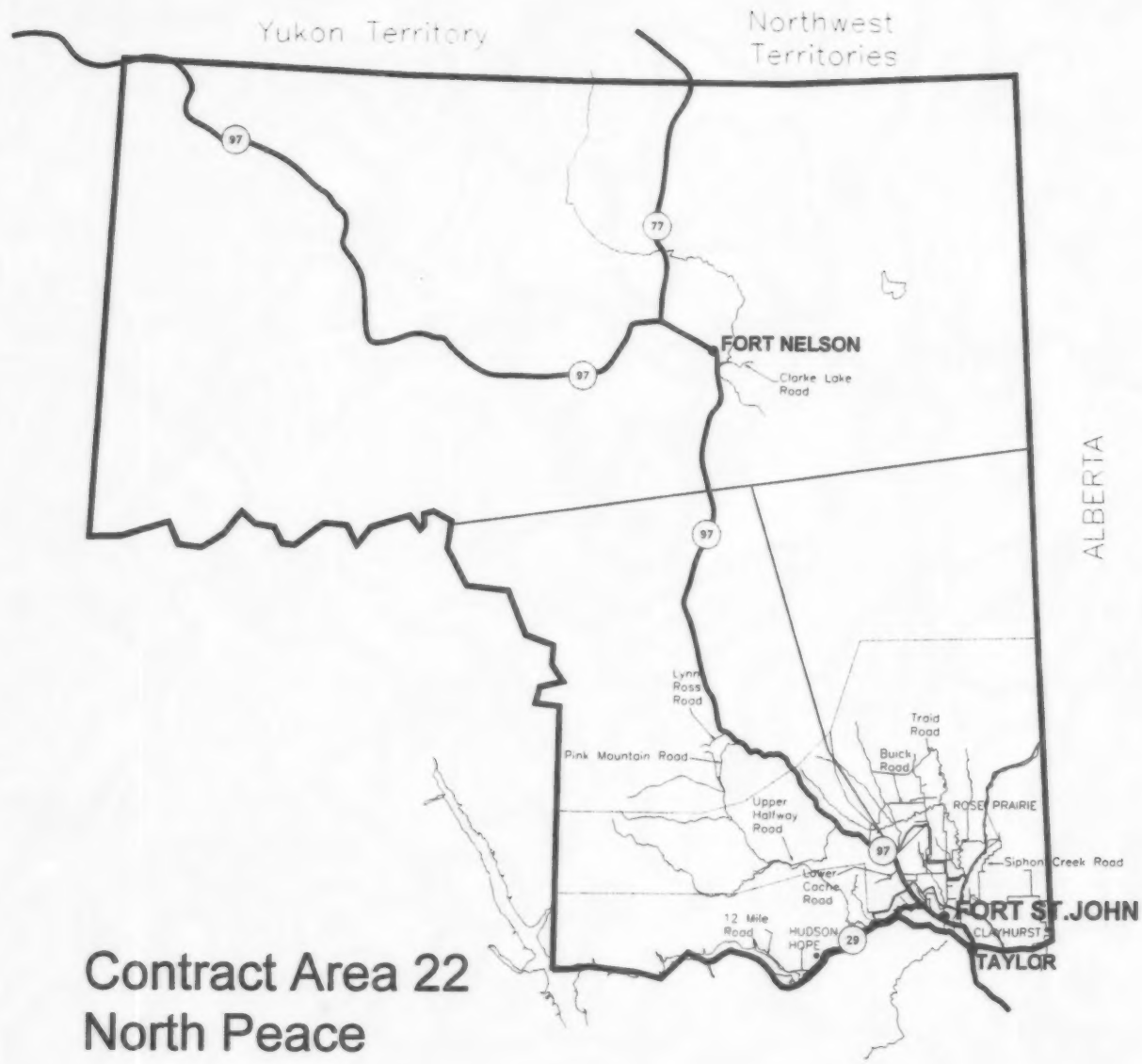

Legend
Wildlife Reflectors
HIXON
97
QUESNEL
26
WELLS
Bowron Lake Road
NAZKO
MCLEESE LAKE
97
97
Contract Area 18
North Cariboo

Contract Area 19
Fort George



Contract Area 20
Robson
MCBRIDE
TETE JAUNE
16
5
Kinbasket Lake
Murtle Lake
BLUE RIVER
Legend
Wildlife Reflectors


Contract Area 21
South Peace
Legend
Wildlife Reflectors
HUDSON'S HOPE
CHETWYND
DAWSON CREEK
TUMBLER RIDGE

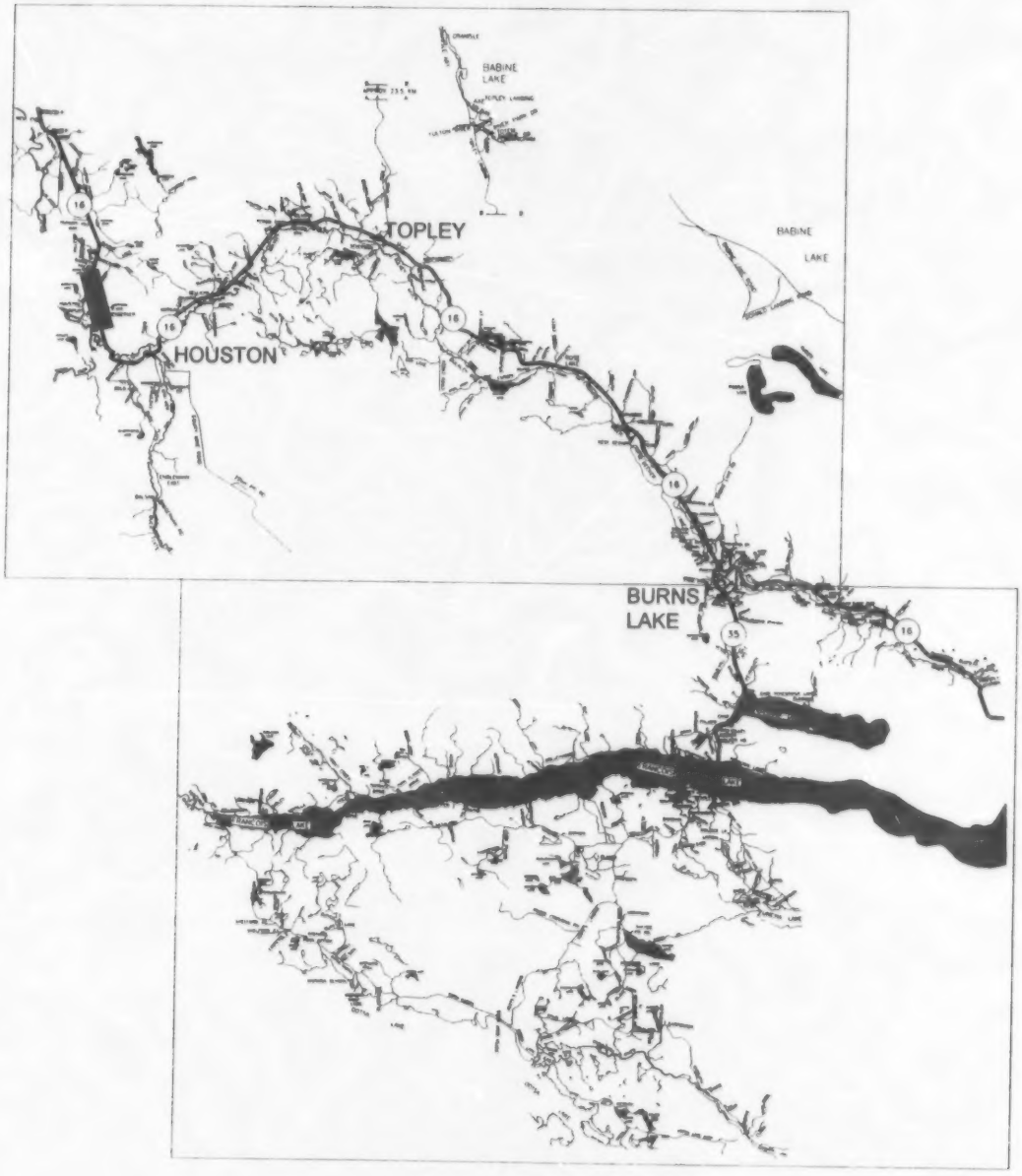


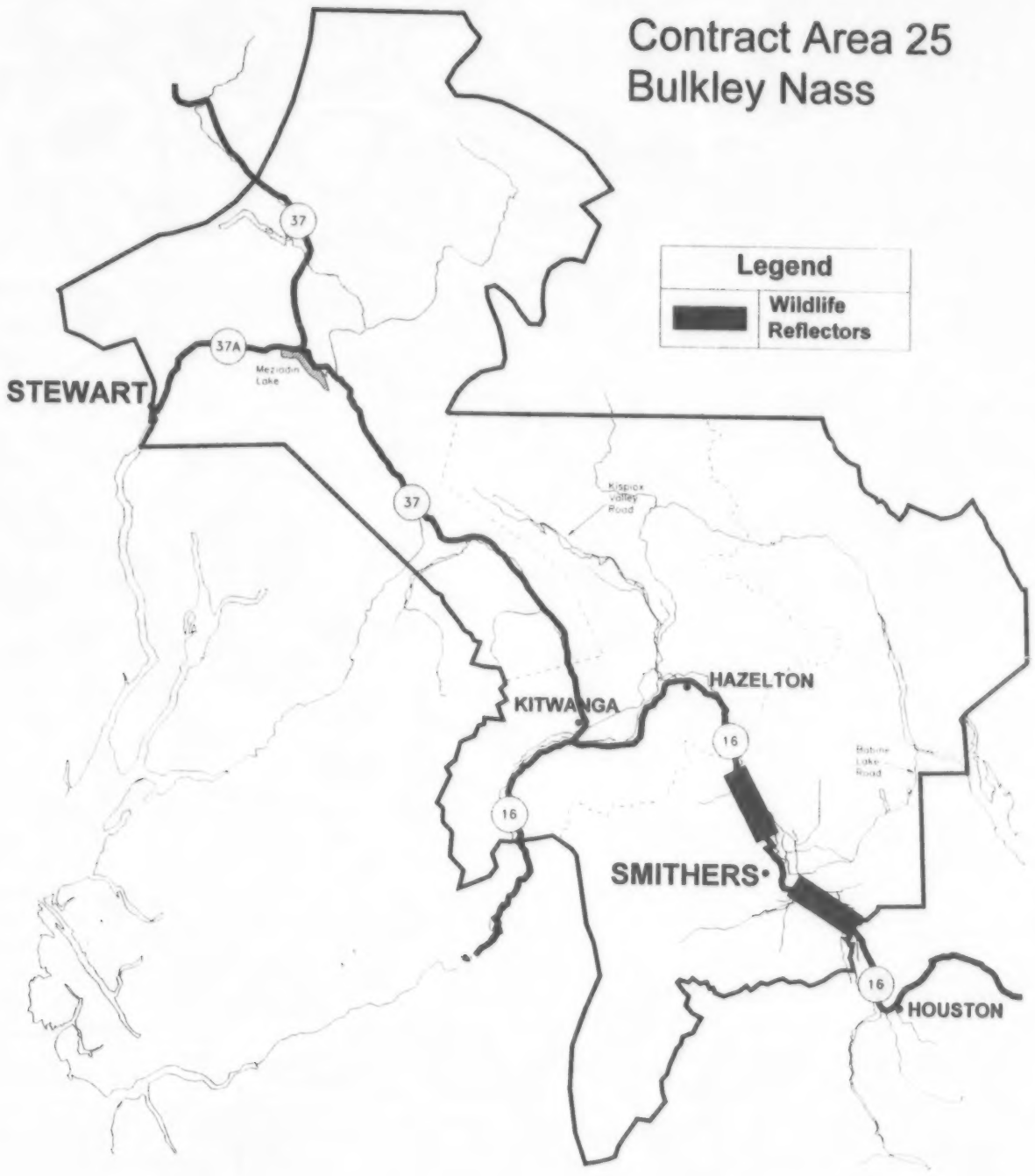
Contract Area 22
North Peace

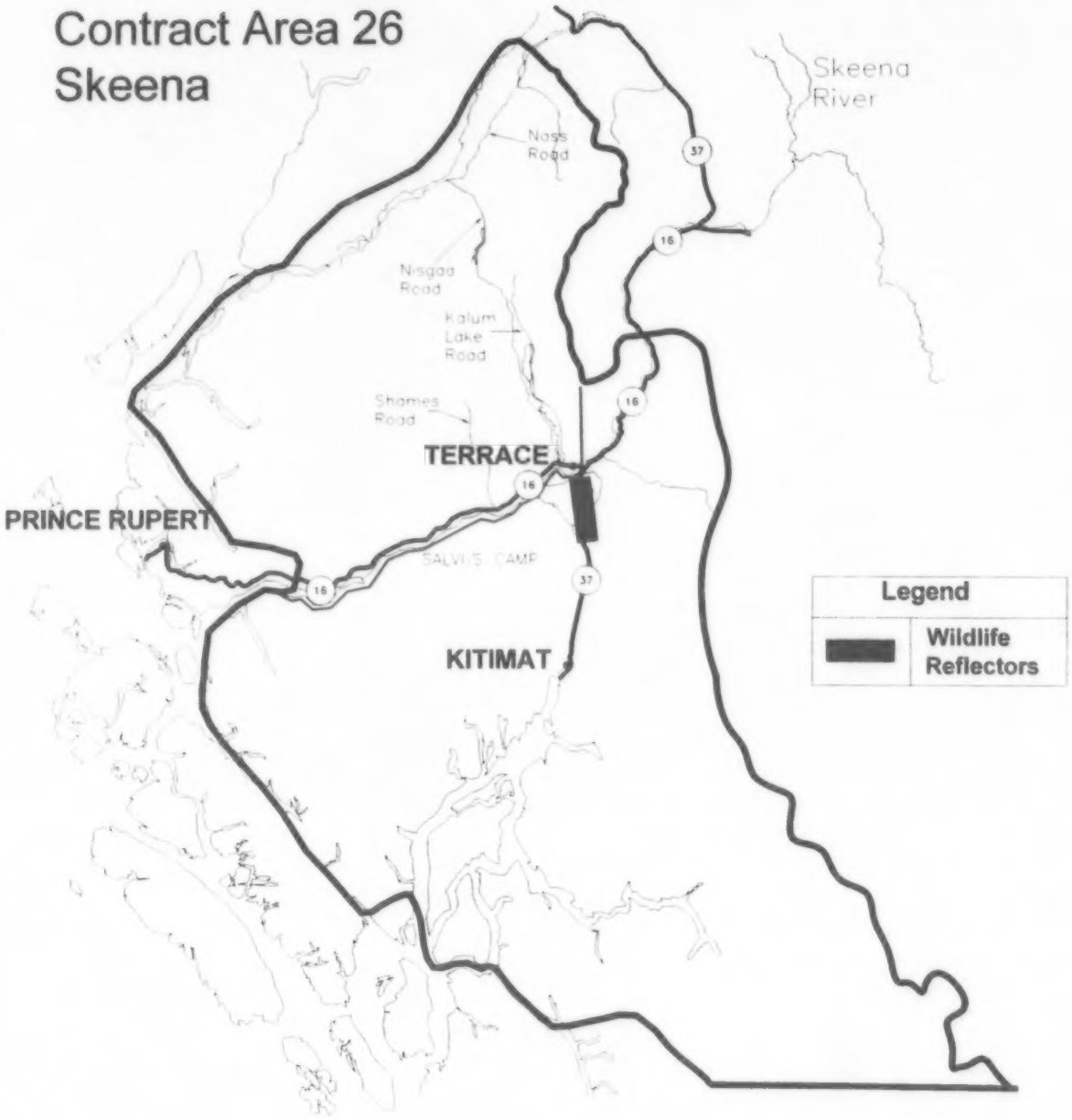
Contract Area 23
Nechako

Contract Area 24
Lakes

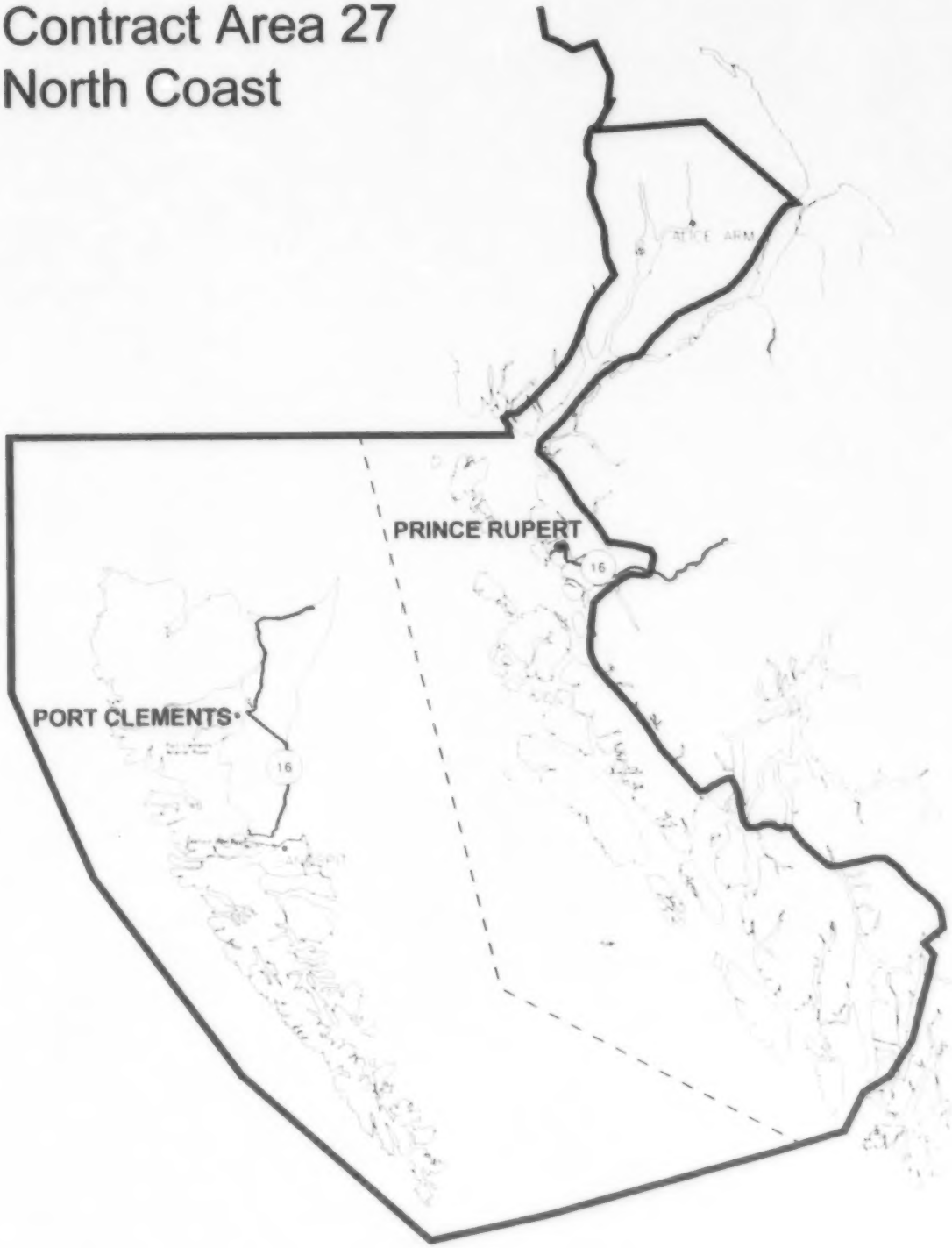
Legend	
	Wildlife Reflectors

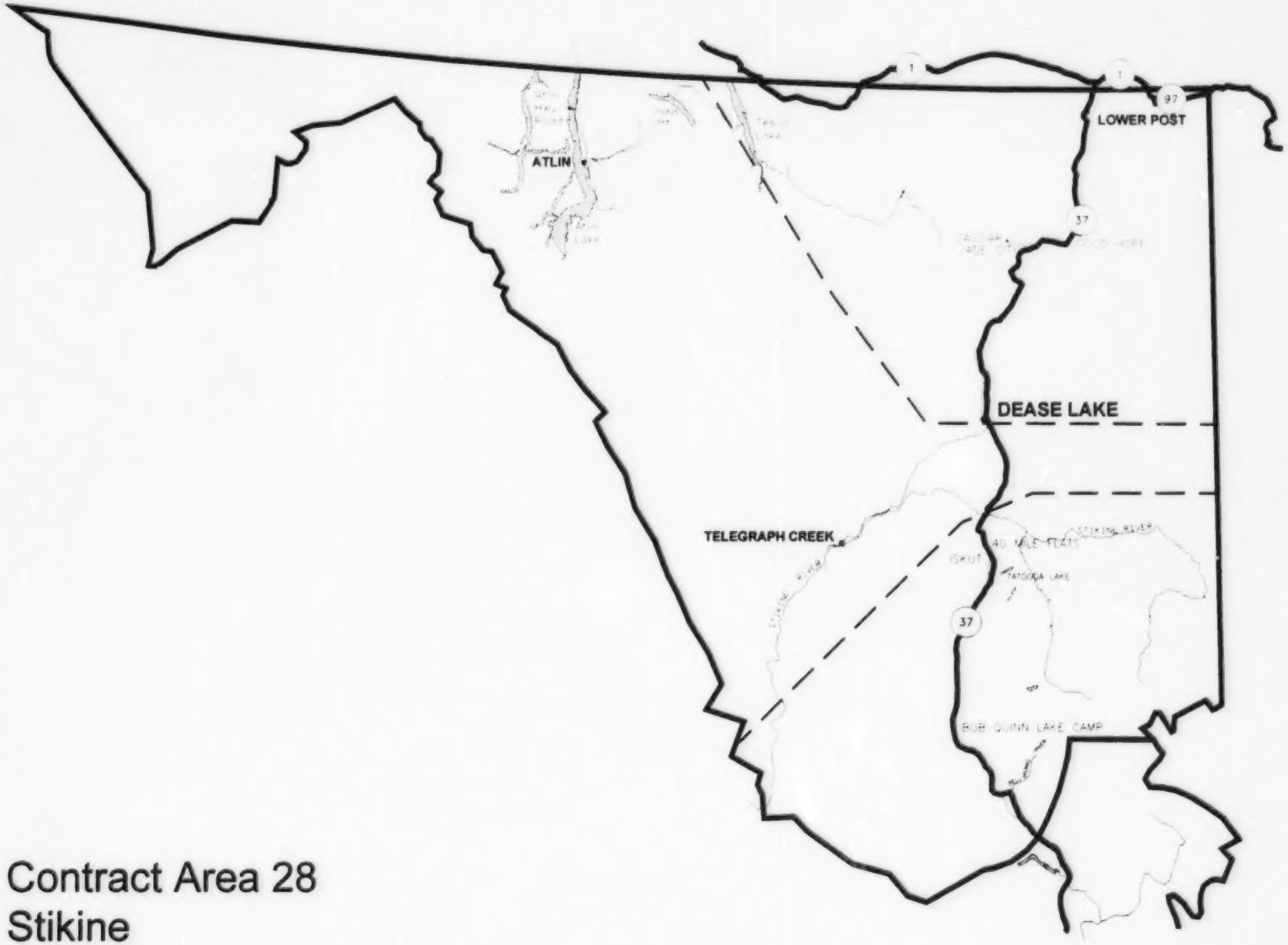



Contract Area 25
Bulkley Nass
Legend
Wildlife Reflectors
STEWART
37
37A
Meziadin Lake
37
Kispiox Valley Road
HAZELTON
KITWANGA
16
Babine Lake Road
16
SMITHERS
16
HOUSTON


Contract Area 26
Skeena
Skeena River
Nass Road
Nisgaa Road
Kalum Lake Road
Shames Road
TERRACE
PRINCE RUPERT
SALVUS CAMP
KITIMAT
37
16
16
16
37
Legend
Wildlife Reflectors

Contract Area 27
North Coast





Contract Area 28
Stikine

APPENDIX B

Wildlife Accident Reporting System (WARS) form H-107 (1999/01)

BRITISH COLUMBIA

Ministry of Transportation and Highways

MONTHLY WILDLIFE ACCIDENT REPORT

Enter the day of the month (e.g. 1, 2, 3, ... etc.) in the "Day" column below.

MONTH *(Please Circle)* Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec **YEAR** _____

REGION *(Please Circle)* 1 2 3 4 5 6 **DISTRICT** _____ **DISTRICT NO.** _____

Day	Time of Kill 1 = Dawn 2 = Day 3 = Dusk 4 = Dark	Location of Killed Animal RFI = Road Features Inventory (optional) LKI = Landmark Kilometre Index (must be completed)						Deer Sign within 100m Y/N	Deer Rfictr Y/N	# Killed	Animal Type Please Specify Sex (Male / Female / Unknown) Please Use "Y" to indicate if Yearling or Younger (Other: Sheep, Caribou, Coyote, Porcupine, etc)												Comments
		Hwy No.	RFI Landmark	RFI Offset	LKI Segment	LKI Km	Nearest Town				Deer M	Deer F	Deer U	Moose M	Moose F	Moose U	Elk M	Elk F	Elk U	Bear M	Bear F	Bear U	Other (please specify)	

Please provide the following information to assist in report follow-ups:

_____ Maintenance Contractor Contact (Please Print) _____ Telephone

_____ Ministry District Contact (Please Print) _____ Telephone

Within 30 days of completion, please send this form to:

Note: If you suspect that an animal has been the target of poachers, please contact your local Conservation Officer or call the ORR (Observe, Record, Report) Line at 1-800-663-9453.